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REMARKS ON THE BRAIN OF THE SEALS.

BY E. C. SPITZKA.

ENGAGED for many years in collecting material for a monograph on the "Marine Mammalia," whose publication has been delayed by the obtaining of new specimens from unexpected sources, and partly by the desire to publish only well-matured and verified observations, I find myself compelled to anticipate my projected paper, in order to correct the manifest errors of the latest publications on this subject.

Dr. Fritz Theodor[1] makes the startling discovery that in the *Phoca* (*Calocephalus*) *vitulina* there is between the two cerebral hemispheres, dorsad of and separated by a gyral interval from the callosum, a second commissure, extending cephalo-caudad nearly as much as that great fiber-bridge. Such an observation would revolutionize all ideas hitherto accepted as to the signification and relations of the callosum, not to mention the peculiar position which such a profound deviation from the mammalian cerebral type would lead morphologists to assign the *Phocidæ*.

On examing Theodor's plate (x., Fig. 4) I find that his so-called "commissura suprema" is the saddest kind of a delusion. In making a medi-section of his seal's brain he sliced off a mesal gyrus, and, deceived by the cut surface, hastily assumed it to be a commissure. How carelessly this was done becomes evident

[1] Das Gehirn des Seehundes (*Phoca vitulina*: Dr. Fritz Theodor, Freiburg i. B., 1887. (The Brain of the Common Seal, by Dr. Frederick Theodor.)

on regarding his Figure 5 (Plate VIII.), where the cortical and gyral structure of the so-called commissure are apparent. Now, lest it might be assumed that he had a monstrosity[2] to deal with in a single specimen, we find that he had two, a younger and an older seal; and furthermore, his artist (Plate IX., Fig. 6) omits the so-called new commissure, furnishing a rather correct representation as I have found it in three brains of the same species.

From a thorough examination of the brains of two sea-lions (*Zalophus Gillespieii*) and three seals[3] (*Phoca vitulina*), I may state the following: The number and complexity of the gyri on the mesal face of the seal's and sea-lion's brain is as great as in the anthropoid brain, and in the frontal region rather more so. Where the falx does not intervene, the gyri are bound firmly together by the leptomeninges. Like all complexly convoluted brains, that of the seal shows considerable asymmetry. In transsection it can be readily seen, even in the sea-lion's brain, that the apices of the gyri of one side interdigitate with the gyri of the other, so that a strictly median section might shave off the former. If we add to this the presumable[4] distortion to which such a complex brain is necessarily exposed during its removal, the likelihood of such an occurrence becomes greatly increased.

If the intrinsic evidence of Theodor's paper, which is really self-condemnatory, did not suffice to show the fallacy of his claims of a *commissura suprema*, I would add the following:

1. In six phocidæ I have exposed the callosum from the mesal fissures, found it contrasting in its brilliant white with the deep gray, or rosy gray (according to age and species) of the cortical surface, as markedly as in man or the anthropoid apes.

2. I have found no other commissure dorsad of it, nor any

[2] Mesofusion of the gyri occurs in monstrosities with absent callosum and absent falx.

[3] A fourth seal was less perfectly studied, owing to the decomposition of part of the brain, although it also confirmed the gross points herein detailed. With the exception of that specimen, which I owed to the N. Y. Aquarium, and one purchased at a fishmonger's, all were obtained through the kindness of Dr. Conklin, Superintendent of the Central Park Menagerie, in a perfectly fresh condition, being removed from the animals within a few hours after their decease.

[4] We should hesitate to assume this if the very figures of Theodor did not positively prove manipulation to have far exceeded the allowable.

fusion of the mesal gyri, nor anything that could remotely suggest even a spurious commissure of the cerebrum.

3. I have made trans-sections of the seal's and sea-lion's brain (the latter being preserved and accessible), and found one, and but one, great[5] transverse commissure uniting the interior white substance of the two cerebral hemispheres of the phocidæ.

If his announcement, on so defective a basis, contradicted by the author's own artist, and positively controverted by careful observation, did not suffice to expose the fallacy of his revolutionizing[6] discovery, the collateral evidence involved in the exposure of the following errors would inculcate the need of caution in accepting the radical propositions with which his paper closes.

He states that the seal has no olives in the sense of the human olive. The seal is, however, noteworthy for the large size of the olivary protuberances. Theodor, in his wretched figure (Plate VIII., Fig. 2), represents the pyramidal columns of the oblongata as showing a roundish swelling laterad. It is to-day generally known to neuro-morphologists that the true pyramids are fascicular, that they can therefore exhibit no enlargement, followed by attenuation, except it be due to a spreading of the fibres, or the inclusion of some other body, such as a ganglion or a commissure. In the sea-lion the same enlargement is distinctly demarkated from the pyramid tract, although not much larger than in the bear. In the sea-lion, as in the bear and other land-carnivora, the hypoglossal nerve roots emerge laterad of the olivary eminence. In man and true apes they emerge mesad of the olive in the groove between the latter and pyramid.[7] In the true seals (*Phoca vitulina*) they emerge partly in the latter situation, and partly from the olivary eminence itself, thus show-

[5] I need not add that I found the pre-commissure developed, and though small, disproportionately to the atrophic olfactory lobes.

[6] It is but doing justice to the author to state that he seems to have been entirely unaware of the bearing of this alleged discovery.

[7] Trans-sections of the oblongata show a tendency of the hypoglossal nerve roots in man to break through the olive proper, but on the ectal face they are collected in a common fascicle.

ing a sort of transitional state. Tiedemann,[8] sixty-eight years ago, in a plate which for accuracy puts those of Theodor to the blush, represents the hypoglossal nerve taking the origin I have ascribed to it, omitting, however, the most cephalic rootlets, which are indeed very frail. Since Theodor cites Tiedemann, it is remarkable that he could have borne the latter's excellent plates in mind, and in conflict with the real facts designated the first cervical as the hypoglossal pair (Plate VIII., Fig. 2).[9] In removing the membrane it is very difficult to avoid tearing off the hypoglossal nerve roots, and it is doubtless due to this fact, and his erroneous naming of the first spinal as the last cranial nerve, that Theodor's non-recognition of the olive is due.

Although the older writers, particularly Tiedemann, have carefully delineated and described lobules of the cerebellum, and especially its vermiform lobe, Theodor in one sentence states that the seal has no *vermis cerebelli* in the sense in which a *vermis* is spoken of in the human cerebellum, and in another proceeds to describe it to be an exceedingly complicated body. Much dependence cannot be placed on his dissections and figures. I have never been able to remove a phocidan cerebellum intact without sacrificing the skull; for the lobulus appendicularis, measuring fully half an inch cephalo-caudal, as much transversely, and one-quarter of an inch dorso-ventral, is almost entirely embedded in bone, and connected with the main cerebellum through a small foramen by a pedicle not exceeding a line in diameter. Theodor has failed to preserve this morphologically important structure, and even to discover his failure to do so, although the most superficial acquaintance with the dog's or cat's brain should have directed his attention to it, particularly in view of his sweeping conclusions as to the phylogeny of the marine

[8] *Icones cerebri simiarum et quorundum mammalium rariorum*, Heidelbergia, MDCCCXXI., Plate II., Figs. 7 and 8. It is to be remarked that Tiedemann attributes olives (*olivæ vix conspicuas*) to the seal, but locates the figure reference laterad of these bodies. The trapeziums he correctly recognizes.

[9] While Tiedemann accurately exhibits the decided caudal direction of the cervical nerves from their origin, which is in remarkable contrast with that of the transversely running hypoglossal, Theodor tilts his nerve roots in the opposite direction. In every respect his figures are far behind Tiedemann's as to accuracy and interpretation.

and terrestrial carnivora.[10] These are expressed as follows: "The seals and (ordinary) carnivora are in their cerebral organization to-day widely separated, and their common origin must be sought in a remote geological period." [Pp. 90–91.]

Now the fact is that an examination of a series of brains beginning with the mink, the fresh-water and salt-water otter, and passing through the eared to the earless seals, would show about as beautiful a transition as a morphologist could well desire. It is misleading to establish a type in a specialized form. The Canidæ and Felidæ are as specialized in this way as the Phocidæ; the Viverridæ, particularly the Ursidæ are more typical carnivores. And on examining a bear's brain, Theodor would have found the same peculiarity of the Island of Reil he found in the seal, excepting the feature due to the peculiar vertical course of the Sylvian fissure in the latter.

Anticipating the more complete monographic publication now in preparation, and which it is intended to illustrate by photographs and other reproductions of both external and internal details, I would summarize the characteristic features of the seal's brain as follows: (1) It is a typical carnivore brain in every essential feature. Morphologically it does not present a single deviation from the type. All differences are due to the relative preponderance of some and relative atrophy[11] of other parts. Thus the olfactory lobe is reduced to such an extent that in some individual common seals the tract is deeply imbedded in the

[10] It seems almost comical that this author, convicted of gross inaccuracies both in his methods, observations and interpretations, should venture upon one criticism of the far more accurate and venerable Tiedemann, in which the former is precisely wrong. He states that the diameter of the Trigemius nerve is exaggerated by him as well as by Gratiolet. It so happens that my measurements in three individuals equal those of the latter, and slightly exceed those of the latter observer.

[11] In brain morphology one must distinguish between physiological peculiarities and intrinsic zoological features. Thus the atrophy in some and absence in other cetaceans of the olfactory bulb is a physiological atrophy; whereas the absence of the epiphysis cerebri would be a profound zoological anomaly. The greater or lesser size of the pyramid tract is in direct physiological parallelism with the voluntary innervation of extremities endowed with prehensile movement, and their absence, presence or development has not such profound significance as has the gyral *type* of the hemispheres, the cerebellum and the olives. It would be possible, therefore, to offer a classification of the higher mammalia based on the *type* of olivary or cerebellar coruscations; whereas the degree of pyramid development would be a less important determining factor.

sulcus, and even invisible in a part of its course, unless the sulcus be opened. In harmony with this the hippocampal lobule is relatively reduced, and remarkably flat. The auditory nerve is enormous, and with this the therewith connected trapezium, lemmiscus lateralis, posterior pair of the corpora quadrigemina and internal geniculate bodies are overgrown. There is a microscopically visible fluted tract on the caudal aspect of the thalamus running ectad from the latter bodies to the auditory cortical field of the hemisphere. It is the enormous hypertrophy of this field which crowds the Sylvian into its unusual vertical, nay, actually anticlinal, position.[12]

One of the most interesting proofs of the value of neuro-morphology in classification is offered by a comparison of the brains and spinal cords of the Cetacea,[13] Sirenia,[14] and Phocidæ. The phocidan brain is, as above stated, a physiologically aberrant, but morphologically genuine carnivore brain. The manatee has the brain of a hippopotamus. The Cetacea, in accordance with their to-day isolated position, have the most aberrant central nervous system of all, but to no other brain do they approach so nearly as to that of the Proboscidia, a group which, with the possible inclusion of other extinct and recent related forms, approaches more nearly the common ancestral trunk from which so widely divergent branches have sprung.[15] Zoological characters

[12] In reality the position of this fissure is dependent on two factors: the lower, corresponding to the cephalic part of the human, has sunk ventro-caudal through the retrogression of the sphenoidal lobe, and the upper (posterior part of the human) has been driven dorso-cephalal by the overgrown auditory cortical field. The same general impression can be conveyed by tilting the tempero-occipital lobe of a putty model of a bear's brain into a foreshortened skull model. Thus the frontal lobe will come to resemble the square and compact contour of the seal's brain. That such a mechanical process has been undergone by the latter is demonstrated by the evident violence to which the olfactory tracts and lobes have been subjected. In no other carnivores are the bulbs so far cephalad and the tracts bodily driven into the depths of the *sulcus rectus*.

[13] A decayed Beluga's brain, and a Phocæna from the N. Y. Aquarium, two beautiful ones of *Tursiops tursio* and one of *Delphinus delphis*, through Mr. Eugene Blackford, of this city. To Professor Wm. F. True, of the Smithsonian, I am indebted for aid in determining the species.

[14] The brain axis and cord of Professor Wilder's specimen, loaned by him.

[15] In stating this I am not misled by the superficial characters, such as the richness in gyri, or in fact any quantitative features. I am determined by the *type* of gyral development, the type of cerebellar foliation, and the character of the olive, which is of the

are more numerous, constant, and of classifying value in a complex organ such as the brain than in the spinal cord.[16] Yet even in this comparatively simple organ specific differences of structure are found, and accordingly the most atypical form is represented in the Cetacea. The ventral horn of gray matter is immensely overgrown, and the dorsal correspondingly atrophic; there is an enormous lateral horn present. On first sight this would appear to be an entirely novel structure, peculiar to the Cetacea; further examination shows that it is homologous with, though an overgrown representative of, a cell-group present in other mammals, which owes its prominence and peculiar position to the following factors: (1) The shrinkage of the neck of the dorsal cornu acts on the extreme ventral and lateral parts of the ventral horn as would the passing of an elastic band around a group of matches, spreading their ends apart; (2) the absence of the pyramid tract in the dorsal part of the lateral column causes an encroachment of the ventral part of the lateral column; (3) the dorsal (posterior) white columns are relatively reduced. To convert a human cord into a porpoise's there must be imagined a shrinkage of the posterior or dorsal white and gray matter, as well as the posterior or dorsal part of the lateral column, in other words, of the entire part of the cord which would lie behind a transverse line which in man leaves nearly as much in front (ventrad of) the central canal as behind (dorsad of) it. This line in the Cetacea would be a curve, and in accordance therewith the outline of the cord in the latter is not nearly circular or a rounded quadrangle as in man, but heart-shaped, the apex being represented by the shrunken posterior or dorsal segment, the bifurcate base by the overgrown halves of the ventral or anterior segment.[17] Although this remarkable deviation is in

compact, massive kind, in contradistinction to the slender lamina type characteristic of rodents, carnivores, apes and man, and whose higher development leads to crenulation. The increase of olivary ganglionic matter in the elephant and porpoise is by aggregation in bulk without crenulation; yet the latter presents true Ungulate features.

[16] The spinal cord of the gorilla in the dorsal region (Waldeyer) shows characters not found in the human cord, a fact long known to me, though not published, from the case of the chimpanzee.

[17] Guldberg has partly observed this, but many years subsequently to my published observations, with which he seems to have been unacquainted.

part due to physiological reasons, yet it is in so far a zoological one as the whole "physiognomy" of the dorsal segment of the cord in the Cetacea is more like that of the Ungulata than the Carnivora. A section of the spinal cord at the level of the foramen magnum has, in every genus, something distinctive, in every family something quantitatively different from other families, in every order something qualitatively and radically distinguishing it from nearly related orders. While, as already stated, such differences have not the profound morphological meaning which certain cerebral features possess, yet it is not from attaching any over-importance to the field to which I have devoted most of my dilettante studies that I venture to prophesy that when the minute and coarse anatomy of the nerve axis be once thoroughly known for each species it will be possible to offer a more correct classification of the Mammalia than any now extant, or any other based on a single criterion. It would not be difficult to enunciate many valuable data for classification furnished by a study of the nerve centres in Sauropsida and Ichthyopsida. Many peculiarities of the appendages of the brain among the former, such as the cartilaginous epencephalic hood of the Chelydra, and the cartilaginous rod attaching the oblongata to the basi-occipital bone in Thalassochelys, require and will repay further study. It is in view of the importance of registering only correct observations that I offer this provisional correction of such revolutionary pseudo-discoveries as those above criticised.

PLATE III.

Fig 1

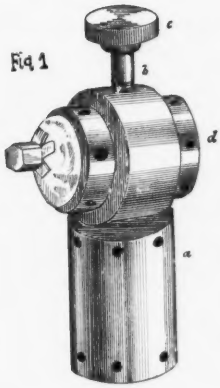


Fig. 2

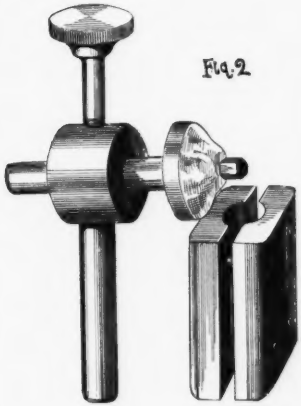


PLATE IV.

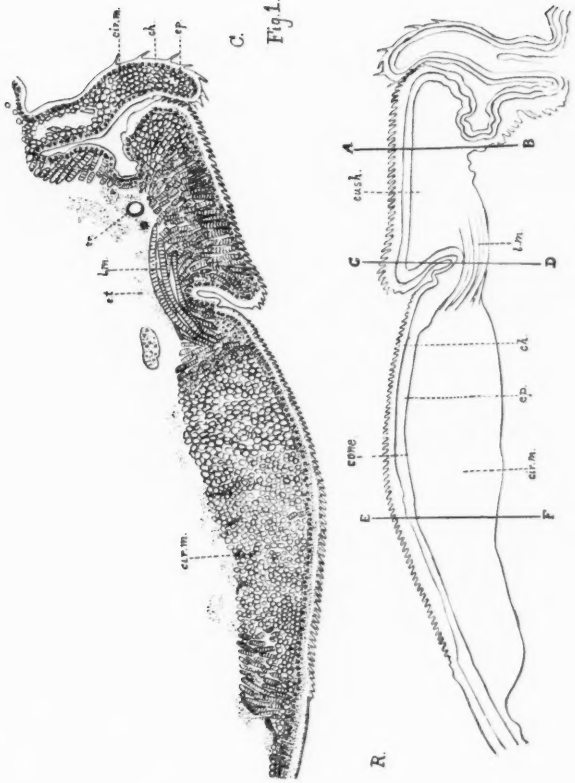


PLATE V.

Fig 2

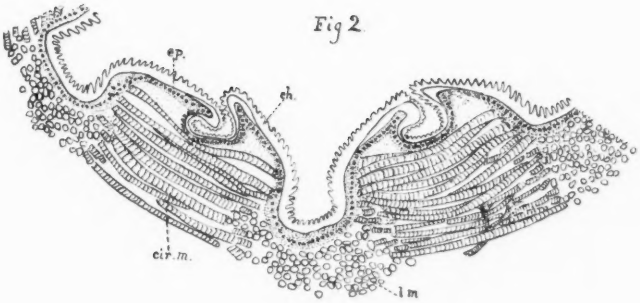


Fig.3.

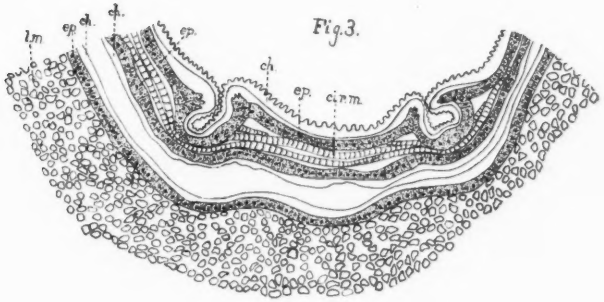
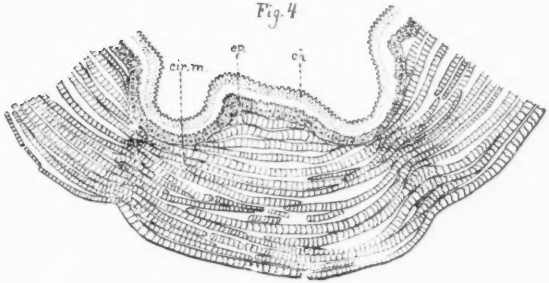


Fig.4



INSTANCES OF THE EFFECTS OF MUSICAL SOUNDS ON ANIMALS.

BY ROBERT E. C. STEARNS.

(Continued from p. 29, Vol. XXIV., 1890.)

CATS AND MUSIC.

MR. GEORGE GUION, of Ventnor, Isle of Wight, referring to a cat owned by his friend, a Capt. Noble, says:

"If any one in her presence commences whistling a plaintive air Brownie will presently go to him, climb into his lap, and raising herself on her hinder legs will put her mouth close to that of the whistler. Captain Noble's view of the motive is, that the cat imagines the performer to be in pain, and thus endeavors to express her sympathy. One day when sitting round the table after dinner, we each for experiment attracted the animal in turn, who on the above supposition must have thought we were suffering from an epidemic, as each of us in succession exhibited the same symptoms. It is necessary that the air whistled should be of a plaintive character, as I found by commencing a lively measure, which I had to change. In my boyhood we had a cat which had a habit very similar. If I laid myself down on the sofa, and made a moaning sound, the cat would jump up and hover about me, as if anxious to find out what was the matter."

Another party writes: "Sometime since I had an ordinary tortoise-shell cat, which had a peculiar fondness for the tune known as "Rode's Air." One day I chanced to whistle it, when, without any previous training, she jumped on my shoulder, and showed unmistakable signs of pleasure by rubbing her head against mine, and trying to get as near my mouth as possible. I have tried many other tunes, but with no avail."

Captain Noble, of Forest Lodge, Maresfield, England, whose cat "Brownie" is referred to by Mr. Guion, in response to the

incident above given says: "By-the-by, I don't know whether 'Rode's Air' is a lively or plaintive tune, but only one of the latter kind affected my poor old 'Brownie.' I used as a rule to whistle the 'Last Rose of Summer,' when I wished her to perform. I never could satisfy myself as to her motive in putting her mouth to mine. The most feasible conjecture that I was able to make seemed to be that she imagined me to be in pain, and in some way tried either to soothe me, or to stop my whistling."

F. C. R., of Gwasted, in commenting on one of the instances above related say: "We too have a cat which is very sensible of the whistling of tunes, and which will, even when with her young kittens, show great uneasiness immediately after the whistling commences, and rise and leave them to follow the person about, ending by trying to seek for the unaccountable sounds in the very mouth of the performer. Still, unlike the cat of 'Musicus,' she seems to experience more uneasiness than pleasure."

Then follows E. J. T., who says: I can give another instance from personal knowledge. A few years ago my brother had a favorite cat, which, when he whistled a tune, would follow him round the room, and climbing up on him would touch his mouth with her paw, and rub her head against his face, all the time purring with pleasure. I may add that this musical taste is *not* hereditary, for a grandchild of this cat, now in our possession, shows the greatest antipathy to music; a few notes on the piano or concertina are enough to rouse her from her slumbers on the hearth-rug, and drive her to the door, mewing loudly to be let out."

Another illustration is furnished by Mr. Oborn, relating to the power of music on English cats. He writes:

"I have a cat that has apparently great fondness for music. Whenever any of the family or a stranger commences playing on the piano, and if the tune is at all lively, she fondles and purrs and evinces the greatest pleasure imaginable, and sometimes becomes so excited that she will jump on to the keys and rub herself against the hands of the person playing."

A lady friend of mine residing in California has observed similar actions on the part of a cat, when the piano is playing in its presence. Whether a Thomas or Tabby cat I did not ask.

Another friend, a lady residing in Washington, D. C., at one time owned a cat that acted in a very peculiar manner upon hearing the music of a piano. When the strain was rather soft and low, the cat appeared to be pleased with it, would climb up into the lady's lap, reach up her head and rub it against the lady's shoulder or chin, but when in the course of the time a passage was reached that was in a high key, with considerable emphasis, pussy became intensely excited, and would put her head against the lady's cheek with a good deal of force, or jump down and run to the piano, and climb up on the person playing, and get up on the instrument in such a fiercely aggressive way that the performer, through fear of being scratched or bitten, would stop playing.

Referring to the effect of whistling upon a cat, as observed by E. J. T., Mr. George O. Howell says, "A relative of mine has a cat, a noble animal, rejoicing under the refined name of Thomas. This creature dislikes to hear any one whistle. But one morning, when he was fast asleep, I whistled loudly. It acted like magic. Thomas started up in an instant, looked very bewildered, and decamped from the room at full speed."

From dogs and cats, the canine and feline, let us turn to the porcine.

PIGS AND MUSIC.

"In old churches and cathedrals we sometimes find a carving on the miserere of a pig playing upon a bagpipe and the little pigs dancing around. This seems to indicate a popular notion (at least in times gone by) that pigs have no ear or taste for music; such a notion, however, seems to be not quite correct, for I once saw four or five great bony pigs standing at a garden gate, listening with the most evident pleasure to the sweet sounds of a wandering German band. They stood in a row, in perfect stillness, with heads bent a little on one side to catch the melody; and from time to time gave utterance to their delight in a gentle grunt of

satisfaction. The melody that charmed their breasts was one which rose and fell in gentle and continual waves of sound; not very attractive perhaps to educated ears, but certainly riveting the attention of these untaught creatures, whose desires are commonly supposed to be confined to the quantity and quality of their food, rather than to the enjoyment of the purer delights of sweet sounds."

In proceeding with the domestic animals it will be seen that the bovine group are entitled to a share of attention.

MUSICAL COWS.

"That pigs are not the only animals who take a delight in musical sounds, may be proved by the following incident of which I was a witness on more than one occasion. Opposite to our house was a large field in which some twelve or thirteen cows were put during the summer months. One day a German band commenced to play on the road which divided the house from the field. The cows were quietly grazing at the other end of the field, but no sooner did they hear the music, than they at once advanced towards it, and stood with their heads over the wall attentively listening. This might have passed unnoticed; but upon the musicians going away, the animals followed them as well as they could on the other side of the wall, and when they could get no further stood lowing piteously, etc. * * * * So excited did the cows become, that some of them ran round and round the field to try and get out, but finding no outlet returned to the same corner where they had lost sight of the band, and it was some time before they seemed satisfied that the sweet sounds were really gone. It seems a strange coincidence that both the pigs and cows were charmed by music produced by a German band."

OXEN AND MUSIC.

"I have often noticed the power music has over oxen. The other day we had a brass band playing in our garden. In a field adjoining were four Scotch oxen; when the band struck up,

they were at the far end of this, a nine-acre field, quite out of sight, the field being very uneven. They set off full trot to the garden wall, put their necks over, and remained so till the tune was finished, when they went back to graze; but as soon as it struck up again, they put their heads over again. This went on till the band left, after which they ate little all day, and were continually lowing."

Before leaving the bovines, it may be worth noticing that the most definite statement, the most direct and practical testimony we have as to the effect of music upon members of this group may be found in that famous book known as "Mother Goose's Melodies." Therein it is stated:

"There was a piper had a cow
And had no hay to give her;
He took a pipe and played a tune,
'Consider, Cow! Consider!'

"The cow considered very well,
And gave the piper a penny,
And bade him play that other tune,
'Corn-ricks are bonny!'"

It will be observed that she was a *hard money* cow, while the piper offered only notes!

"There are many anecdotes which show that the ox, or cow, has a musical ear. The carts in Corunna, in Spain, make so loud and disagreeable a creaking sound with their wheels, for the want of oil, that the governor once issued an order to have them greased; but the carters petitioned that this might not be done, as the oxen liked the sound, and would not draw so well without their accustomed music."

"Prof. Bell assures us that he has often, when a boy, tried the effect of the flute on cows, and has always observed that it produced great apparent enjoyment. Instances have been known of the fiercest bulls being calmed into gentleness by music."

It will be seen that a very liberal definition must be conceded to the terms music and musical sounds, when the creaking of a

cart wheel is referred to as "accustomed music."[1] The instance here quoted may be more properly regarded as illustrating the relation of certain sounds to the ordinary routine, and said sounds having been continued for a long time, until they became a permanent factor in the experience of these animals, the discontinuance caused, perhaps, a feeling of strangeness and discontent.

SHEEP AND MUSIC.

The following pleasing anecdote of the power of music is given by the celebrated Haydn. "In my early youth," says he, "I went with some other young people equally devoid of care, one morning during the extreme heat of summer, to seek for coolness and fresh air on one of the lofty mountains which surround the Lago Maggiore, in Lombardy. Having reached the middle of the ascent by daybreak, we stopped to contemplate the Barromean Isles, which were displayed under our feet, in the middle of the lake, when we were surrounded by a large flock of sheep which were leaving their fold to go to the pasture.

"One of our party, who was no bad performer on the flute, and who always carried the instrument with him, took it out of his pocket. 'I am going,' said he, 'to turn Corydon; let us see whether Virgil's sheep will recognize their pastor.' He began to play. The sheep and goats, which were following one another towards the mountain, with their heads hanging down, raised them at the first sound of the flute, and all with a general and hasty movement turned to the side from whence the agreeable noise proceeded. They gradually flocked round the musician, and listened with motionless attention. He ceased playing, and the sheep did not stir.

"The shepherd with his staff now obliged them to move on; but no sooner did the fluter begin again to play than his innocent auditors again returned to him. The shepherd, out of patence, pelted them with clods of earth, but not one of them would move. The fluter played with additional skill; the shepherd fell into a passion, whistled, scolded, and pelted the poor

[1] But then Will Carleton's verses are sometimes called poetry.

creatures with stones. Such as were hit by them began to march, but the others refused to stir. At last the shepherd was forced to entreat our Orpheus to stop his magic sounds; the sheep then moved off, but continued to stop at a distance as often as our friend resumed the agreeable instrument.

"The tune he played was nothing more than a favorite air, at the time performing at the opera in Milan. As music was our continual employment, we were delighted with our adventure; we reasoned upon it the whole day, and concluded that physical pleasure is the basis of all interest in Music."

Having given much time to the domesticated quadrupeds, the domesticated bipeds, our friends who wear feathers, must be permitted to give their testimony.

I am again indebted to Prof. Davidson for many interesting anecdotes, all the more so as the instances recited have the authority of his personal knowledge, or that of others known to him as truthful and intelligent.

BIRDS AND MUSIC.

First relating to pigeons. "It must have been about 1841 when I had gotten rid of about fifteen pairs of pigeons of different varieties; but I retained a fine white 'hen pigeon' because we all felt a kind of attachment towards her,—the younger brothers and sisters and my mother. I was going through the task of learning the flute from my father's teaching; I had only a one-keyed flute, but of very sweet tone. One white pigeon had always made herself at home about the back part of the house, frequently leaving the large pigeon house and coming into the kitchen; but after the sale of all the other pigeons she was continually amongst our feet, and making close friends with one and all. In the course of my fluting we noticed that this white pigeon became very much excited over one particular tune, but as to others she seemed wholly unconcerned. So, to please the younger portion of the family, as well as my mother, I frequently cleared a space for the pigeon to perform in and commenced to play. She would begin to circle round and round in the most excited man-

ner, in a space say six feet or more in diameter, crouching low, spreading out her wings, and cooing in the most intense tones. It was very interesting to us all, and the louder I played the more excited became the bird. She never exhibited any feeling for any other tune. Very frequently my mother would ask a neighbor or two in to see the performance, and to still further test the pigeon's idiosyncrasy, I would begin to play while she was outside, when she would instantly leave her corn and come in for the music. Two of my sisters write me that the tune was 'Rule Britannia,' and that the pigeon was then ten years old. Subsequently I purchased other pigeons and mated her, after which she evidently considered music too frivolous for such aged maternity."

(*To be continued.*)

REVIEW OF THE PROGRESS OF AMERICAN INVERTEBRATE PALEONTOLOGY FOR THE YEAR 1889.

BY CHARLES R. KEYES.

ALTHOUGH the number of titles is somewhat in advance, the results of studies in American invertebrate paleontology issued during the past twelve months do not compare as favorably as might be expected with those of previous years. Works of a monographical character have been numerically very limited; but a goodly proportion of the briefer papers foreshadow important publications now in a more or less advanced stage of preparation.

A very considerable number of reprints continue to appear entirely repaged. It is to be hoped that where this is found desirable the original pagination will also be allowed to remain for convenience in reference. The time and patience consumed in looking up the correct citations of repaged authors' editions detracts greatly from the value of these excerpts by thwarting the very purpose which they were designed to serve.

The small number of species described during the past year is rather surprising, but it clearly indicates that the species from the most accessible localities have been already described. It is with considerable satisfaction that the present trend of thought, as disclosed in the papers of the year, is noted; and that paleontologists have begun to appreciate more fully the direct bearing and close relations of the science to those branches dealing with the structure of animals and their distribution in time and space. The few morphological facts already brought out by the investigation of fossil forms is only suggestive of the vast and fertile field open to the student who directs his energies along these lines. Thus intimately connected with biology, the results of the study of the material already accumulated cannot but give most valuable aid in making out the phylogenetic history of the living zoölogical groups. And, indeed, the importance of this consid-

eration cannot be overestimated in the attempt toward a complete phylogeny of organic beings. Viewed from an anatomical and embryological standpoint, the dead become rejuvenated; the "curious stones" live; the rocks disclose the great plan of life. More lasting, more useful, more worthy of contemplation are paleontological labors directed thus rather than to the indiscriminate multiplication of species, to the mere description of curiosities.

Not less important is the recognition of the mutual dependence of paleontology and stratigraphy for the attainment of the highest and most accurate results in generalizations. Heretofore these fields have been far too widely separated; and the work of one has been carried on practically independently of the other, with often very erroneous conclusions. But the present record shows that, in one instance at least, an intimate knowledge of both has been happily combined in the production of a very high grade of work.

In the Canadian *Record of Science* for July Henry M. Ami has a paper On a Species of Goniograptus from the Levis Formation, Levis, Quebec; and in the October number of the same journal, Additional Notes on *Goniograptus thureauni* McCoy, from the Levis Formation of Canada.

Charles Barrois, in the Faune de Calcaire d'Erbray (Mém. de la Soc. Geol. du Nord, tome III., April, 1889), discusses the relations of the American and European Devonian faunas; that of the region in question bearing a great resemblance to the North American Oriskany and Upper Helderberg.

Charles E. Beecher, in the Memoirs of Peabody Museum, Yale University, Vol. II., Part 1, has an important contribution to the knowledge of that rare group of silurian sponges, the Brachiospongidæ; and, in the September number of the *American Journal of Science*, a Note on the Spider *Arthrolycosa antiqua* Harger.

In the number for February 4, 1889, Vol. CVIII., of the *Comptes Rendus*, is a note on Les Blattes de l'epoque houillère, by Charles Brongniart.

Samuel Calvin describes a new species of Spirifera from the Hamilton Group near Iowa City; and Synonymy, Characters and

Distribution of *Spirifera parryana* Hall. Both in the Bulletin of the Laboratories of Natural History of the State University of Iowa.

H. J. Carter sketches the History of known Fossil Sponges in Relation to those of the Present, in which some general considerations respecting classification are brought out. Also, Further Observations on the Foraminiferal Genus Orbitoides of d'Orbigny. The first is in the October, and the second in the March, number of the *Annals and Magazine of Natural History*.

A valuable morphological memoir on the Development of some Silurian Brachiopoda, by J. M. Clarke and Charles E. Beecher, forms Part I., Vol. I., of the Memoirs of the New York State Museum. In the Forty-second Annual Report N. Y. State Museum the first author has: The Genus Bronteus in the Chemung Rocks of N. Y.; The Hercynian Question; and a List of Species constituting the known Fauna and Flora of the Marcellus Epoch in the State of New York.

William F. Cooper gives a Tabulated List of Fossils known to occur in the Waverly of Ohio. Bulletin Denison University, Vol. IV., pp. 123–130.

William H. Dall, in a paper on the Hinge of Pelecypods and its Development, with an Attempt toward a better Subdivision of the Group, seeks more immutable criteria than generally adopted, for the systematic arrangement of the class. *American Journal of Science* for December.

William Dawson has a Note on *Saccamia eriana* in the *American Journal of Science* for April; and on Fossil Sponges from the Beds of the Quebec Group of Sir William Logan, in the *Canadian Record of Science* for July.

In the *Annals and Magazine of Natural History* for March, P. Martin Duncan considers some Points in the Anatomy of the Species of Palæechinus; and a proposed classification. The genus is limited, and two North American forms referred to the group as now restricted.

A. F. Foerste notes some Cambrian Fossils from the Limestone of Nahant, Mass. Proc. Boston Soc. Nat. Hist., p. 291.

The Geological Department of the British Museum publishes Part I. of an exhaustive Catalogue of the Fossil Cephalopods, by

Arthur Foord. The portion issued embraces seven families, of which are carefully drawn up the characters of each genus.

James Hall discusses some Crustacean Tracks from the Potsdam Sandstone of Port Henry, N. Y., in the Annual Report of the New York State Museum. The State Geologist's Report was also issued separately in an edition of eight hundred copies.

C. L. Herrick describes about forty new species, and considers others, in Lists of Waverly Fossils. Bulletin Denison University, Vol. IV., pp. 11–60, and continued on pp. 97–123. In the *American Geologist* for February the same writer has Notes on the Waverly Group of Ohio.

Robert T. Hill publishes a chapter on the Palæontology of the Trinity Division in the Neozoic Geology of Southwestern Arkansas (Vol. II., Ann. Rept. Ark. Geol. Sur); Palæontology of the Cretaceous Formations of Texas, Part I.; and a Check List of the Invertebrate Fossils from the Cretaceous Formations of Texas.

In the Canadian *Record of Science* for April, G. J. Hinde writes on Archæocyathus Billings, and other Genera allied thereto or Associated therewith from the Cambrian Strata of North America, Spain, Sardinia, and Scotland; and in the July number of the same journal, on a New Genus of Siliceous Sponges from the Trenton Formation at Ottawa.

Alpheus Hyatt ably discusses the Genesis of the Arietidæ in the Smithsonian Contributions to Knowledge, No. 673.

T. R. Jones has some Notes on Paleozoic Bivalve Entomostraca: North American Species. (*Can. Annals and Mag. Nat. Hist.*, 6th Series, Vol. III.)

T. Rupert Jones and J. W. Kirkby publish a paper on Some Ostracoda from the Mabou Coal-field of Nova Scotia, in the *Geological Magazine* for June. The first author also describes some species of Palæozoic Ostracoda from Pennsylvania, U. S., in the *American Geologist* for December.

Charles R. Keyes has a list and some notes on the Löss (Post-Pliocene) fossils of the State, in an Annotated Catalogue of the Mollusca of Iowa (Bulletin of Essex Institute, Vol. XX.); Soleniscus, its Generic Characters and Relations, in THE AMERI-

CAN NATURALIST, May number; Variations Exhibited by a Carbonic Gasteropod, *American Geologist* for June; Note on the Distribution of Certain Löss Fossils, *American Geologist*, August, 1889; Lower Carbonic Gastropoda from Burlington, Iowa, Proceedings Academy Natural Sciences, Philadelphia, for September 24, 1889; the American Species of Polyphemopsis, ibid.; Sphærodoma; A Genus of Fossil Gastropods, ibid.; The Carboniferous Echinodermata of the Mississippi Basin, *American Journal of Science*, September number; and The Sub-generic Groups of Naticopsis, *American Geologist* for October.

F. H. Knowlton describes a Problematic Organism from the Devonian at the Falls of the Ohio, in the *American Journal of Science*, March number.

Joseph Leidy, in the Ann. Rept. Geol. Sur. Pa., for 1887, has a Notice of Fossils in Caves and Crevices of the Limestone Rocks of Pennsylvania; chiefly vertebrates.

J. P. Lesley publishes as Report (P. 4) of the Second Pennsylvania Geological Survey, a Dictionary of the Fossils of Pennsylvania and neighboring States.

In the *American Geologist* for March Jules Marcou describes the Original Locality of *Gryphæa pitcheri*.

G. F. Mathew has: A Second Note on Stenotheca, in the *Geological Magazine*, May number; On the Cambrian Organisms in Acadia, in the Canadian *Record of Science* for July; and On Remarkable Organisms of the Upper Silurian and Devonian of New Brunswick, in the Transactions of the Royal Society of Canada, Vol. VI.

S. A. Miller has issued North American Geology and Paleontology, with a catalogue of the species described to date.

Kentucky Fossil Shells from the Silurian and Devonian rocks are described by Henry Nettleroth in one of the monographs of the Ky. Geol. Survey.

H. A. Nicholson discusses the Relations between the Genera Syringolites Hinde, and Roemeria Ed. & H., and the Genus Caliapora Schlüter, in the October number of the *Geol. Mag.*

A. S. Packard briefly notes some Recent Discoveries in the Carboniferous Flora and Fauna of Rhode Island, *American Jour-*

nal of Science, May; and in the Proceedings of the Boston Society of Natural History, Vol. XXIV., pp. 209–11, are some Palæontological Notes.

E. N. S. Ringueberg reviews the Calceocrinidæ, with Descriptions of New Species, in Annals of N. Y. Acad. Science, Vol. IV., 1889.

Ferdinand Roemer has a paper, bearing the date 1888, Ueber eine durch die Häufigkeit Hippuritenartiger Chamiden ausgezeichnete Fauna der oberturonen Kreide von Texas.

J. M. Safford and A. W. Vogdes, in the Proceedings Academy Natural Sciences of Philadelphia, describe New Species of Fossil Crustacea from the lower Silurian of Tennessee.

Charles Schuchert gives a List of Fossils occurring in the Oriskany Sandstone of Maryland, New York, and Ontario. Annual Report New York State Museum for 1888.

Samuel Scudder has the Oldest Known Insect Larva, *Mormolycoïdes articulatus*, from the Connecticut river Rocks. Mem. Boston Soc. Nat. Hist., Vol. III., No. 13.

N. S. Shaler notes the Occurrence of Fossils of the Cretaceous Age on the Island of Martha's Vineyard, in the Bulletin Museum of Comparative Zoölogy, Vol. XVI., No. 5.

In the *American Geologist* for August some New Characters of *Dophyphyllum simcoense* Billings are given by Will H. Sherzer.

Charles Wachsmuth and Frank Springer have, in the Proceedings of the Academy of Natural Sciences of Philadelphia, dated November 27, 1888, two morphological contributions on the Discovery of the Ventral Structure of Taxocrinus and Haplocrinus, and Consequent Modifications in the Classification of the Crinoidea; and Crotalocrinus: Its Structure and Zoölogical Position.

Charles D. Walcott has an important article in the May and July numbers of the *American Journal of Science* on the Stratigraphic Position of the Olenellus Fauna in North America and Europe. In advance sheets of the Proceedings of the U. S. National Museum for 1888, the same author describes New Genera and Species of Fossils from the Middle Cambrian; a Fossil Lingula Preserving the Cast of the Peduncle; and a New

Genus and Species of Inarticulate Brachiopod from the Trenton Limestone.

Charles A. White considers the Permian Formation of Texas in THE AMERICAN NATURALIST for January; and Invertebrate Fossils from the Pacific Coast in Bulletin 51, U. S. Geological Survey.

J. F. Whiteaves, in Contributions to Canadian Palæontology, Vol. I., Part 2, has: On some Fossils from the Hamilton Formation of Ontario; Fossils of the Triassic Rocks of British Columbia; and on Some Cretaceous Fossils from British Columbia. In the Transactions Royal Society of Canada, Vol. VII., Descriptions of Eight New Species of Fossils from the Cambro-Silurian Rocks of Manitoba.

The Bulletin of the American Museum of Natural History, Vol. II., No. 2, contains, by R. P. Whitfield, Observations on some Imperfectly Known Fossils from the Calciferous Sandrock of Lake Champlain, and Descriptions of several New Forms; Additional Notes on *Asaphus canalis* Conrad; Description of a New Form of Fossil balanoid Cirripede from the Marcellus Shale of New York; and a Note on the Faunal Resemblance between the Cretaceous Formation of New Jersey and that of the Gulf States.

H. S. Williams has an abstract in the Proceedings A. A. A. A. for 1888 on the Use of Fossils in Determining the Age of Geological Terranes; and in the *American Geologist* for April, the Relation of the Devonian Fauna of Iowa.

N. H. Winchell notices the Discovery of Lingula and Paradoxides in the Red Quartzites of Minnesota, in the Bulletin Minnesota Academy of Natural Science, Vol. III.

Anthony Woodward, in the Journal of the New York Microscopical Society, gives a Preliminary List of Foraminifera from Post-Pliocene Sand at Santa Barbara, California.

Henry Woodward notes the Discovery of Turrilepas in the Utica Formation of Ottawa, Canada, in the *Geo. Mag.* for June.

E. O. Ulrich has some Polyzoa and Ostracoda from the Cambro-Silurian Rocks of Manitoba, in Contributions to the Micro-Palæontology of the Cambro-Silurian Rocks of Canada, Part 3; on Lingulasma, a new Genus, and Eight New Species of Lingula

and Trematis, in *Amer. Geol.* for June; and in the same journal for April, Preliminary Description of New Lower Silurian Sponges.

Warren Upham mentions some Marine Shells and Fragments of Shells in the Till near Boston, in *American Journal of Science*, May number.

AUTOTOMY IN THE CRAB.

BY E. A. ANDREWS.

THAT crabs when roughly handled may throw off one or more legs at a point close to the body, is a fact well-known and often observed.

As little bleeding takes place in such cases, and as the crab may thus escape complete destruction, and is able to grow new legs, this power of self-amputation is of evident advantage to the species, and might at first sight be regarded as an intelligent act consciously performed by the crab under certain circumstances.

The experimental work of Léon Fredericq has, however, demonstrated that such amputations are merely reflex acts brought about by special mechanisms, and may be included with similar phenomena in other animals under the term "Autotomy."

From the various publications upon this subject we may abstract the chief facts relating to the crab, as given by the above author in his *Travaux du Laboratoire*, I.-II., 1887–8.

He there shows that this rupture of the limbs is not due to fragility, since the weight necessary to break off a limb is many times that of the crab's body, and the rupture thus produced is an irregular one, taking place generally at some joint of the limb, and not at the normal "plane of rupture."

That, moreover, this autotomy is not a voluntary act was shown as follows: A crab when fastened by one or more legs endeavors to escape, but does not hit upon the expedient of throwing off a fastened leg, though if even a free leg is seriously injured, the crab then amputates it. When the brain (supra-

œsophageal ganglion) is removed, the self-amputation may still be brought about: the same result follows when the brain is thrown out of the experiment by anæsthetizing the animal with ether or chloroform.

Peripheral stimuli may be applied to the limb in various ways in order to bring about autotomy; thus crushing or cutting the segments of the leg (unless it be the terminal ones) is very soon followed by the falling off of the leg at a definite point near the body, while alcohol, etc., heat, or electric shocks applied to the limb produce the same result. In the latter case the time between the application of the shock and the resulting autotomy was measured and found to vary much.

The centre for the reflex throwing off of the legs is in the thoracic ganglion mass, since the removal of this mass destroys the autotomy, and since in one case electric stimuli applied to this mass brought about the ordinary autotomy!

Concerning the mechanisms by which the impulse going out from this centre is able to bring about the remarkable rupture of the limb at a definite place, the author points out the existence of a special groove around the limb of the crab, on the second segment from the body, and that this segment is moved in two directions by two muscles, raised upward by an extensor and brought downward by a flexor muscle. These two muscles are attached to the upper and lower borders of the second segment at the end towards the first, and pass into the first. When autotomy takes place the limb separates by a clear-cut plane passing across the second segment through the above groove; the stump or first segment, with a small ring from the second, is now held forcibly in an elevated position. Experiment shows that the flexor may be cut without destroying the power of autotomy, while when the extensor is cut autotomy does not take place.

The action of the extensor muscle in autotomy, the author explains as follows, with the use of the diagram reproduced in Fig. 1. The stimulus coming from the leg to the thoracic centre results in the sending out of stimuli to the muscles of the leg, the strong contraction of the extensor (*ex*) brings the leg forcibly against the carapace (*c*) or the fingers of the experimenter, etc.,

till the reaction produces strain enough to rupture the second segment (*s*) at the groove or weakest point (*a*).

Some observations made upon the region where autotomy takes place, or plane of rupture as we may call it, seem of interest in supplementing the above account from an anatomical point of view. In the crab Libinia the chitinous wall of the limbs is exceeding thick and strong, so that to break it at all —and it will not break with a clear-cut fracture—considerable force is required, so that it seemed to me quite puzzling that the crab could throw off its legs with a smooth, clear-cut fracture, and this by the application of some force acting inside a firm cylinder.

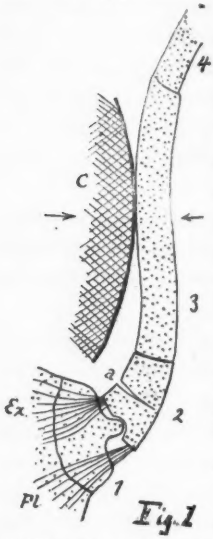


Fig. 1

Experiments made were confirmatory of the facts demonstrated by Léon Fredericq—that autotomy is a reflex act, and that apparently and *probably* it is brought about by muscular contraction forcing the limb against the thorax.

Examination of the second segment shows these two grooves around it (*p* and *d*, Fig. 2) differing in appearance, but both conspicuous from the absence of hairs and hair pores in the exoskeleton along these lines. When autotomy takes place the limb separates along the proximal line (*p*), and the exposed edges of the exoskeleton are smooth and sharp cut. The exposed surface of the soft central part of the limb is covered by a firm membrane except at the centre, where there is a rounded hole with a little torn tissue and blood exposed. After a time a chitinous layer appears over the end of the stump or short ring remaining as representative of the second segment. Though artificial rupture cannot ordinarily be brought about at this "plane of rupture," yet when the limb is

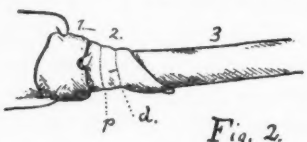


Fig. 2.

decalcified in Perenyi's fluid, it readily separates there just as in autotomy.

Sections of this region of the second segment show that the exoskeleton presents a definite plane of discontinuity in the lamellar structure at the proximal groove (*p*, Fig. 2), this plane being at right angles to the length of the limb, but bending abruptly in the outer part of the exoskeleton, so that after autotomy the exoskeleton of the stump of the limb is somewhat rounded off at its outer edge (*x*, Fig. 3.) This plane of discontinuity is quite different from the pores that penetrate the exoskeleton, and connect with the peculiar scale-like "hairs" (*h*, Fig. 3.) Extending from this exoskeleton part of the "plane of rupture," there is a definite structure in the soft part of the limb forming a double annular curtain (*p*, *r*, Fig. 4), extending inward from the epidermis to the central nerve and blood vessels (*n* and *b*), and thus dividing the cavity of the second segment into a proximal and a distal part,—nearly separated from one another. This curtain is a membranous structure of which the distal part is more delicate, the proximal stouter and of a double nature. This proximal membrane is seen on section to remain upon the stump of the leg, as the conspicuous membrane mentioned above, after normal autotomy.

There is thus a definite "plane of rupture," or preformed mechanism consisting of a modification (*x*) in the exoskeleton (*ex*), and of a membranous ingrowth (*p*, *r*), which together account for the peculiar surface presented after autotomy takes place.

The explanation of the gradual acquisition by the crabs of this highly complex and perfected form of autotomy by natural selection presents difficulties which may, I judge, be lessened if we can show reasons for supposing that the mechanisms involved have their homologues in other animals, and have risen to their perfect expression in the crabs in connection with *change of function.*

Leon Fredericq has shown that the chelæ are thrown off easily, by autotomy, in the craw-fish, while the other legs are either thrown off with difficulty, in the lobster, or not at all, in his experiments on the crayfish. Examinations of these limbs showed

that (as easily can be verified) the chelæ have, as in the crab, a groove on the second segment, while the other legs present a free joint at the corresponding point, making thus two segments in place of one, or seven in all in place of six in the chelæ.

Considering the relations of the crab to the Macrurans, there seems no doubt that the second segment in the leg of the former represents the fused second and third segments in the latter; the "plane of rupture" corresponds in position with the free joint between the second and third segments of the leg in the lobster or crayfish.

The appearances seen on sectioning this plane, may, I judge, be explained as a modification of a former free joint; the double membrane and line of discontinuity of exoskeleton representing the invagination of body-wall seen at an ordinary movable joint where tendons for attachment of muscles are formed.

As the lobster appears to have the power, though feebly developed, of throwing off the legs at the free joint between the second and third segments, and as this power is better developed in the chelæ, where fusion of the above segments has taken place, may we not suppose that the more perfect and ready autotomy in the crab has been gradually derived from the former conditions as a "change of functions" took place from a movable joint to a definite "plane of rupture"?

That this "plane of rupture" is found in the Megalops (as I infer from examinations of alcoholic specimens) does not, I think, invalidate the above conclusion.

Of the two grooves seen on the second segment of the crab's leg it is the proximal one that corresponds to the rupture plane of the lobster's chelæ; the distal one being represented in the lobster by a deep depression, possibly bearing some relation to the exopodite.

PLATE VI.

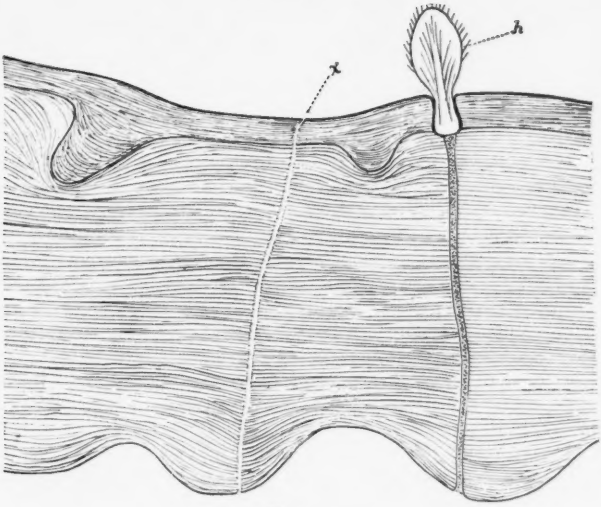


FIG. 3.

FIG. 4.

THE HISTORY OF GARDEN VEGETABLES.

BY E. L. STURTEVANT.

(Continued from p. 48. Vol. XXIV., 1890.)

PARSNIP CHERVIL. *Chærophyllum bulbosum* L.

THE roots of this plant, appearing almost like a short carrot, but generally smaller, are eaten boiled; a sub-variety has the roots nearly round.[1] The wild plant is described by Camerarius[2] in 1588, and by Clusius[3] in 1601, and is also named by Bauhin[4] in 1623. As a cultivated plant it seems to have been first noted about 1855, when the root is described as seldom so large as a hazel nut, while in 1861 it had attained the size and shape of the French round carrot.[5] It appeared in American seed catalogues in 1884 or earlier, and was described by Burr[6] for American gardens in 1863. It was known in England in 1726, but was not under esculent culture.[7]

The *Parsnip chervil*[5], *turnip-rooted chervil* or *tuberous-rooted chervil*, is called in France, *cerfeuil tubereux*, *cerfeuil bulbeux*; in Germany, *korbelrube*, *kerbelrube*; in Flanders and Holland, *knollkervel*; in Denmark, *kjorvelroe*; in Spain, *perifollo bulboso*.[8]

PATIENCE DOCK. *Rumex patientia* L.

This species is less acid than the common sorrel, and is occasionally grown for the same purposes. De Candolle[9] thinks it the *Rumex sativus* of Pliny. The name *monk's rhubarb*, or *rhabarbarum monachorum* of Tragus, 1552, indicates its presence in

[1] Bon Jard., 1884, p. 37.
[2] Camerarius. Hort., 1588.
[3] Clusius. Hist., 1601, II., 200.
[4] Bauhin. Pin., 1623, 161.
[5] Gard. Chron., 1861, 887, 906.
[6] Burr. Field and Gard. Veg., 1863, 31.
[7] Treas. of Bot., I., 74.
[8] Vilmorin. Les Pl. Pot., 1883, 79.
[9] Decandolle. Geog. Bot., II., 847.

the gardens of the monasteries, It was called *patientia* by Parkinson in 1640, and is noted by Turner[10] in 1538, as having in England the common name of *Patience.* It is noted as cultivated and its use as a vegetable in nearly all the early botanies, and is recorded in American gardens in 1806.[11] There are no varieties described.

Patience Dock or *Herb Patience* is called in France, *oseille spinard, patience, parelle, epinard immortel, choux de Paris, doche, dogue ;* in Germany, *Englischer spinat, winter-spinat ;* in Flanders, *blijvende spinazie ;* in Denmark, *engelsk spinat ;* in Italy, *lapazio, rombice ;* in Spain, *romaza, acedera espinaca, espianaca perpetua ;* in Portugal, *labaca ;*[12] in Norway, *have-syre; ;*[13] in the Mauritius, *patience.*[14]

PEA. *Pisum sativum* D.C.

The history of the garden pea is difficult to trace, as its separation from the field pea cannot be expected to have been noted in early and popular reference. The use of the seed as an esculent, however, dates from a very remote antiquity, as pease have been excavated from the ruins of ancient Troy,[15] and have been recovered from tombs at Thebes.[16] Its culture among the Romans is evident from the mentions by Columella, Pliny and Palladius.[17] There is every reason to believe from the paucity of description that peas were not then in their present esteem as a vegetable, and were considered inferior to other plants of the leguminous order. The first distinct mention of the garden pea that I find is by Ruellius[18] in 1536, who says there are two kinds of peas, one the field pea and trailing ; the other a climbing pea, whose fresh pods with their peas were eaten. Green peas, how-

[10] Turner. Libellus, 1538.
[11] McMahon. American Gar. Cal., 1806, 550.
[12] Vilmorin. Les Pl. Pot., 395.
[13] Schubeler. Culturpflanz, 81.
[14] Bojer. Hort. Maur., 1837, 272.
[15] Decandolle. Orig. Des. Pl. Cult., 272. ; Am. Antiquarian, Oct. 1880, 66.
[16] Wilkinson. Ancient Egyptians.
[17] Columella. Lib. II., c. 10 ; Lib. XI., c. 1. ; Pliny, Lib. XVIII., c. 31 ; Palladius, Lib. X., c. 6.
[18] Ruellius. De Nat. Stirp., 1536, 439.

ever, were not a common vegetable at the close of the 17th century. The author of a life of Colbert, 1695, says: "It is frightful to see persons sensual enough to purchase green peas at the price of 50 crowns per litron." This kind of pompous expenditure prevailed much at the French Court, as will be seen by a letter of Madame de Maintenon, dated May 10, 1696. "This subject of peas continues to absorb all others," says she; "the anxiety to eat them, the pleasure of having eaten them and the desire to eat them again, are the three great matters which have been discussed by our princes for four days past. Some ladies, even after having supped at the Royal table, and well supped too, returning to their own homes, at the risk of suffering from indigestion, will again eat peas before going to bed. It is both a fashion and a madness."[19] In England garden peas appear to have been rare in the early part of Elizabeth's reign, as Fuller observes they were seldom seen, except those which were brought from Holland, and "these," says he, "were dainties for ladies, they came so far and cost so dear."[20] These references may, however, refer to peas out of season, but in 1683, Worlidge[21] says the meaner sort "have been long acquainted with our English air and soil, but the sweet and delicate sorts of them have been introduced into our gardens only in this latter age."

I propose, however, to only trace out the antiquity of the various forms which include varieties, not the history of the species, nor the varieties themselves. The varieties noted are innumerable, and occur with white and green seed, with smooth and with wrinkled seed, with seed black spotted at the hilum, with large and small seed; as well as with plants with large and small aspect; on dwarf, trailing and tall plants, and those with edible pods.

I. WHITE AND GREEN PEAS.

Lyte, in his edition of Dodonæus, 1586, mentions the trailing pea, or what Vilmorin classifies as the half-dwarf, as having round seed, of color sometimes white, sometimes green.

[19] Gard. Chron., 1843, 71.
[20] Glasspoole. Ag. of O., 1875, 520.
[21] Syst. Hort. By J. W. Gent., 1683, 197.

II. SMOOTH SEEDED.

Dodonæus, in his Frumentorum, 1566, describes this form under *Pisum minus*, a tall pea, called in Germany *erweyssen;* in Brabant, *erwiten;* in France, *pois;* by the Greeks, *ochron;* the pods containing eight to ten round peas of a yellow color at first, then green. This pea was called in England, *Middle Peason*, in 1591.[22]

III. WRINKLED SEED.

The first certain mention I find is by Tragus in 1552, under Phaseolus. These are also recorded in Belgian and German gardens by Dodonæus in his Frumentorum, 1566, under *Pisum majus*, the dry seed angular, uneven, of a white color in some varieties, of a sordid color in others. He calls them *roomsche erwiten, groote erwiten, stock erwiten*, and the plant he says does not differ from his *Pisum minus*, and indeed he uses the same figure for the two. Pena and Lobel in 1570,[23] describe the same pea as in Belgian and English gardens, under the name *An Pisum angulosum hortorum quadratum Plinii*, but the seed of a ferruginous and reddish color, and Lobel [22] in 1591 figures the seed, using the name Pisum quadratum, and it seems to be the Great Peason, Garden Peason, or Branch Peason of Lyte in 1586, as he gives Dodonæus' common names as synonyms. In 1686, Ray [24] describes this class under the name of Rouncival, and refers to Gerarde's picture of Pisum majus, or Rowncivall Pease, in 1597, as being the same. This word *Rouncival*, in white and green varieties, was used by McMahon [25] in America in 1806, and *Rouncivals* by Gardiner and Hepburn [26] in 1818, and Thorburn in 1828. The first good description of the seed is, however, in 1708, when Lisle [27] calls it honey-comb or pitted. Mr. Knight, a nurseryman of Bedfordshire, before 1726 [28] did much for the

[22] Lobel. Ic., 1591, II., 66 and index.
[23] Pena & Lobel. Adv., 1570, 396.
[24] Ray. Hist., 1686, 892.
[25] McMahon. Am. Gard. Cal., 1806, II.
[26] Gardiner & Hepburn. Am. Gard., 1818, 59; Thorburn's Cat., 1828.
[27] Lisle. Husb., 1757, 169.
[28] Townsend. Seedsman, 1726, 2.

improvement of the pea, and sent out several wrinkled varieties Up to this time the wrinkled peas do not seem to have been in general esteem. The Knight pea, the seed rough, uneven and shrivelled, the plant tall, was in American gardens in 1821,[29] and quite a list of Knight's peas are under present cultivation.

IV. BLACK-EYED PEAS.

These are mentioned as of an old sort by Townsend[28] in 1726, and are grown now under the name of Black-eyed Marrowfat.

V. DWARF PEAS.

These are mentioned by Tournefort[30] in 1700, and are referred by him to 1665. I find no earlier distinct reference.

VI. HALF-DWARFS.

These are the ordinary trailing peas as mentioned by the earlier botanies, as for instance the *Pisum minus* of Camerarius, 1586, etc.

VII. TALL PEAS.

These are the forms described by the early botanies as requiring sticking, as the *Pisum majus* of Camerarius, 1586; the *Pisum* of Fuchsius, 1542; *Phasioli or faselen* of Tragus, 1552, etc.

VIII. EDIBLE-PODDED OR SUGAR PEAS.

The pods and peas of the large climbing pea are recorded as eaten, as also the green pods of the trailing form, by Ruellius[31] in 1536, and this manner of eating is recorded by later authors. We now have two forms, those with straightish and those with contorted pods. The first of these is figured by Gerarde[32] in

[29] Cobbett. Am. Gard., 1821.
[30] Tournefort. Inst., 1719, 394.
[31] Ruellius. l. c., 439.
[32] Gerarde. Herb., 1597, 1045.

1597, is described by Ray[33] in 1686, Tournefort in 1700, etc. The second form is mentioned by Worlidge[34] in 1683 as the *Sugar pease* with crooked cods, by Ray[33] as *Sickle pease*. In the Jardinier Français, 1651, Bonnefonds describes them as the Dutch pea, and adds that until lately they were very rare, and Roquefort says they were introduced to France by the French ambassador in Holland about 1600.[35] In 1806, McMahon includes three kinds among American esculents.

About 1683, Meager[36] names nine kinds in English culture; in 1765 Stevenson,[37] thirty-four kinds; in 1783 Bryant[38] names fourteen; 1806 McMahon[39] has twenty-two varieties; Thorburn's Calendar, 1821, contains eleven sorts, and his seed catalogue of 1828 had twenty-four sorts; in 1883 Vilmorin describes one hundred and forty-nine; in the report of the New York Agricultural Experiment Station for 1884, ninety-three varieties are described in full.

Peas and *peason* are named in America in 1535, 1540, 1562, etc., but we cannot be sure from the references whether peas or beans of the pea-shape were intended. In 1602, however, peas were sown by Gosnold[40] in the Elizabeth Islands off the coast of Massachusetts, were grown from French seed by the Indians of the Ottawa river in 1613,[41] were grown in excellent quality by the colonists of Massachusetts in 1629,[42] and in 1779 were among the Indian foods destroyed by General Sullivan in western New York.[43]

The *pea* is called in France, *pois;* in Germany, *erbse;* in Flanders and Holland, *erwt;* in Denmark, *haveoert;* in Italy,

[33] Ray. Hist., 1686, 891.
[34] Syst. Hort., 1683, 197.
[35] Gard. Chron., 1843, 71.
[36] Meager. Eng. Gard., 89.
[37] Stevenson. Gard. Cal., 1765, 90.
[38] Bryant. Fl. Dict., 1783, 305.
[39] McMahon. Am. Gard. Cal., 1806.
[40] Smith's Virg. Pinkerton Coll. XIII, 20.
[41] Parkman. Pion. of Fr., 352.
[42] Higginson. Mass. Hist. Soc. Col., 1st ser., I, 118.
[43] Conover. Early Hist. of Geneva, 47.

pisello; in Spain, *guisante;* in Portugal, *ervilha;*[44] in Norway, *ert;*[45] in Greece, *pizelia, aukos;*[46] in Russia, *gorock.*[47]

In Bengali, *matar,*[46] *burra-mutur;* in Ceylon, *rutagoradia;*[48] in Cochin China, *dau-tlon;*[49] in Egyptian, *besilleh;*[47] in Hindustani, *muttir,*[49] *matar, dana,*[46] *buttani;*[48] in India, *mutur;*[50] in Japan, *wan, nora mame;*[51] in Sanscrit, *harenso;*[48] in Tamil, *puttanie;*[49] in Telinga, *goondoo sani gheloo.*[48]

PEANUT. *Arachis hypogæa* L.

This is rather a plant of field than garden culture, yet it is included by Vilmorin among his kitchen garden esculents. It seems to be of New World origin, as jars filled with the nuts have been found in the mummy pits of Peru and Pachacamac,[52] as I have myself verified at the National Museum, and Bentham[53] inclines to the same belief, as the other known species of the genus, five in number, are all Brazilian. Garcilasso de la Vega,[54] who was a boy at the time of the conquest of Peru, speaks of this plant under the name of *ynchic*, called *mani* by the Spaniards. The first writer who notes it is Oviedo in his Cronica de las Indias, who says the Indians cultivate very much the fruit *mani;* a little later Monardes (1569) describes a plant which is probably this. Before this the French colonists, sent in 1555 to the Brazilian coast, became acquainted with it under the name of *mandobi*, which Jean de Lery describes.[55] It was figured by Laet in 1625,[55] and by Marcgrav in 1648[56] as the *anchic* of the Peruvians, the *mani* of the Spaniards.

[44] Vilmorin. Les Pl. Pot., 423.
[45] Schubeler. Culturpfl., 136.
[46] Pickering. Ch. Hist., 283.
[47] Heuze. Les Pl. Alim., II., 447.
[48] Birdwood. Veg. Prod. of Bomb., 123.
[49] Ainslie. Mat. Med., I., 297.
[50] Speede. Ind. Handb. of Gard., 119.
[51] Kæmpfer. Amoen, 835.
[52] Squiers. Peru, 81.
[53] Gray. Bot. U. S. Exp. Ex., 424.
[54] G. de Vega. Royal Coun., Hak. Soc., Ed. II., 360.
[55] Pharmacographia, 186.
[56] Marcgravius. Bras., 1648, 37.

It was included among garden plants by McMahon in 1806, and Burr in 1863 describes three varieties, but Jefferson speaks of its culture in Virginia in 1781. Its culture was introduced to France in 1802,[57] and it was described among pot-herbs by Noisette[58] in 1829.

The peanut, earth nut, ground nut, grass nut, pindar, or earth almond, is called in France *arachide, pistache de terre, souterraine, anchic, arachine, feve de terre, noisette de terre, pistache d'Amerique, pois de terre;* in Germany, *erdnuss, erdeichel;* in Italy, *cece di terra;* in Spain, *chufa, cocahueta, alfonsigo;* in Portugal, *amenduinas*[59]; in the Mauritius, *pistache.*[60]

Birdwood[61] gives a Sanscrit name *boochanaka;* Hindustani, *moongphulli, booe-moong;* Tamil, *vayer, nelay-cordalay;* Telinga, *nela senaglu, veru-sanaga;* in Sumatra, *cachang-goring.* In Angola, *mpinda* or *ginguba;*[62] in Egypt, *foul sennar, sennar-bean.*[63] In Tagalo, *mani;* in Burma, *myae-bai.*

PENNYROYAL. *Mentha pulegium* L.

The leaves of pennyroyal are sometimes used as a condiment. Mawe,[64] in England, in 1778, calls it a fine aromatic, and it was among American pot-herbs in 1806.[65] It was in high repute among the ancients, and had numerous virtues ascribed to it by both Dioscorides and Pliny, and from the frequent reference to it in Anglo-Saxon and Welsh works on medicine, we may infer that it was much esteemed in northern Europe.[66] It has now fallen into disuse.

Pennyroyal, in old herbals *puloil royal,* a name derived from the Latin *pulcium regium,* from its supposed efficacy in destroying

[57] Bon Jard., 1882, 685.
[58] Noisette. Man., 1829, 329.
[59] Vilmorin. Les Pl. Pot., II.
[60] Bojer. Hort. Maurit., 1837, 116.
[61] Birdwood. Veg. Prod. of Bomb., 117, 299.
[62] Montiero. Angola, 72.
[63] Pickering. Ch. Hist., 736.
[64] Mawe. Gard., 1778.
[65] McMahon. Am. Gard. Cal., 1806.
[66] Pharmacographia, 1779, 486.

fleas,[66] is called in France *menthe pouliot*;[67] in Germany, *polei;* in Holland, *poley;* in Italy, *pulegio;* in Greece, *gluphone* or *vlehoni;* by the Turks, *filis cun;* in Egypt, *hobag*.[68]

PEPPERMINT. *Mentha piperita* L.

Peppermint is grown on a large scale for the sake of the oil which is obtained by distillation, and which finds large use for flavoring candies and cordials, but especially in medicine. There are large centres of its culture in the United States, Europe, and Asia, but we are now concerned with its appearance as a pot-herb, for which it is grown to a limited extent, the leaves used for seasoning. It is spoken of as if not a garden plant by Ray,[69] in 1724, who describes two varieties, the broad and narrow leaved. In 1778 it is included by Mawe[70] among garden herbs; in 1806 noticed among American garden plants,[71] and is now an escape from cultivation. I find no notice of the peppermint preceding 1700, when it is mentioned by Plukenet[72] and Tournefort,[73] and is noted as a wild plant only.

Peppermint is called in France *menthe poivree;* in Germany, *pfeffermunze;* in Denmark, *pebbermynte;*[74] in the Mauritius, *pepermenthe;*[75] in India, *beelluta* or *panee kula;*[76] in Egypt, *lemmane* or *na na;* in Bengali and Hindustani, *pudina*, also in Hindustani, *nana;* in Japan, *faki*.[77]

PEPPERS. *Capsicum annuum* L.

This plant is of American origin, and is first mentioned by Peter Martyr in an epistle dated September, 1493, wherein he says Columbus brought home "pepper more pungent than that

[67] Vilmorin. Les Pl. Pot., 354.
[68] Pickering. Ch. Hist., 199.
[69] Ray. Syn., 1724, 234, n. 7.
[70] Mawe. Gard., 1778.
[71] McMahon. Am. Gard. Cal., 1806.
[72] Plukenet. Almag. maut., 1700, 129.
[73] Tournefort. Instit., 1719.
[74] Vilmorin. Les Pl. Pot., 353.
[75] Bojer. Hort. Maurit., 247.
[76] Speede. Ind. Handb. of Gard., 183.
[77] Pickering. Ch. Hist., 671.

from Caucasus."[78] It is also mentioned as a condiment by Chanca, physician to the fleet of Columbus in his second voyage to the West Indies, in a letter written in 1494 to the chapter of Seville.[79] It had already existed in tropical and southern America under cultivation in numerous varieties. These have been described under many specific names by Fingerhuth [80] and other botanists, but those varieties at present under northern cultivation can all be referred to the annual species, although differing exceedingly in the form, color, and quality of their fruits. These varieties furnish a number of groups which are quite distinctly defined, and which seem in many cases to present specific characters, and these groups or types have existed unchanged now for several centuries, despite the different conditions to which they have been exposed.

In the varieties under our present cultivation, the only ones which I propose to notice, we have distinct characters in the calyx of several of the groups; and in the fruit being pendulous and erect, and it is worthy of note that the pendulous varieties have a pendulous bloom as well as fruit, and the erect varieties have erect bloom, and some heavy fruits are erect, while some light fruits are pendulous; and in the quality of the fruit, as for instance all the sweet peppers having a like calyx; and in the color of the fruit. While again there may seem at first to be considerable variability in the fruits even on the same plant, yet a more careful examination shows that this variability is more apparent than real, and comes from a suppression or distortion of growth, all really being of a similar type.

The history of the appearance of each of these groups can best be seen by the synonymy, which is founded upon figures given with the descriptions, and which is intended to be conservative rather than complete.

I. The calyx embracing the fruit.

(*a.*) Fruit pendulous.

[78] Irving. Columbus, III., 425, I., 238.

[79] Pharmacographia, 406.

[80] Fingerhuth. Monog. Gen. Capsici, 1832.

This form seems to have been the first introduced, and presents fruits of extreme pungency, and is undoubtedly that described as brought to Europe by Columbus.

It presents varieties with straight and recurved fruit; and the fruit when ripe is often much contorted and wrinkled.

Capsicum longum. D.C. ex., Fing., t., VI.

Siliquastrum tertium. Langer Indianischer pfeffer. Fuch., 1542, 733.

Siliquastrum minus. Fuch., l. c., 732.

Indianischer pfeffer. Siliquastrum. Roszlin, 1550, 214.

Indianischer pfeffer. Trag., 1552, 928.

Piper indicum. Cam. epit., 1586, 347.

Capsicum oblongius Dodonæi. Lugd., 1587, 632.

Piper indicum minus recurvis siliquis. Hort. Eyst., 1613, 1713.

Piper indicum maximum longum. Hort. Eyst., 1613, 1713.

Capsicum recurvis siliquis. Dod., 1616, 716.

Piper Calecuticum, sive Capsicum oblongius. J. Bauh., 1650, II., 943.

Siliquastrum, Ind. pfeffer. Pancov., 1673, n. 296.

Piper Capsicum. Chabr., 1677, 297.

Piment de Cayenne. Vilm., 1885, 151.

Long Red Cayenne. Ferry.

Mexican Indian, four varieties, one the exact variety of Fuchsius, 1542.

Siliquastrum majus. Fuch., 1542, 732.

Long Yellow Cayenne. Hend.

Capsicum longum luteum. Fing., t. VII.

According to Sloane [81] the following are additional synonyms as taken from non-botanical writers.

Poivre indic. cornu. Lery, 205.

Axi longum acre, Martyr. Axi lungo. F. Colon, Vit., 74.

Axi, or *West Indian Pepper.* Purchas, 1100, 1106.

White and red long pepper. Carder, ib., 1190.

Pepper growing on trees in a picked length running out. Layfield, ib., 1173.

Pepper growing in long cods. Smith's Obs., 54.

[81] Sloane. Cat., 1696, 39.

Red pepper like a child's coral two inches long. Ligon, 79.
Quein-boucoup. Thevet, Cosm., 938.

(*b.*) Fruits erect.

Capsicum annuum acuminatum. Fing., t. II.
Piper ind. minimum erectum. Hort. Eyst., 1613, 1713.
Piper ind. medium longum erectum. Hort. Eyst., 1613, 1713.
Piper longum minus siliquis recurvis. Jonston, Dendrog., 1662, t. LVI.
Piment du Chili. Vilm., 1883, 410.
Chili pepper. Vilm., 1885, 151.
Red Cluster. Vilm., Alb. de Cl.
Yellow Chili. Hend.

II. Calyx pateriform, not covering the flattened base of the fruit.

(*a.*) Fruit long, tapering, pendent.

Piper indicum sive siliquastrum. Pin., 1561, 12.
Capsicum actuarii. Lob. Obs., 1576, 172; ic., 1591, I., 316.
Capsicum majus. Lugd., 1587, 632.
Capsicum longioribus siliquis. Ger., 1597, 292.
Piper indicum. Matth. Op., 1598, 434.
Capsicum oblongioribus siliquis. Dod., 1616, 716.
Pepe d'India. Cast. Dur., 1617, 344.
Figures 13 and 14, counting in order. Piso, de Ind., 1658, 226.
Guinea pepper or garden coral. Pomet, 1748, 125.
Piper indicum bicolor. Blackw. Herb., 1754, n. 129, f. II.
Piment rogue long. Vilm., 1883, 409.
Long red capsicum or Guinea. Vilm., 1885, 150.

(*b.*) Fruit short, rounding, pendent.

Siliquastrum quartum. Fuch., 1542, 734.
Siliquastrum cordatum. Cam. Epit., 1586, 348.
Fig. 2 and 6. Piso, 1658, 225.
Piper cordatum. Jonston, Dend., 1662, t. LVI.
Capsicum cordiforme, Mil. Fing., t. IX.
Oxheart. Thorb.
New Oxheart. Thorb.

III. Calyx funnel form, not embracing base of fruit.

(*a.*) Fruit pendent; long.

Piper indicum medium. Hort. Eyst., 1613, 1713.
Piper siliquis flavis. Hort. Eyst., 1613, 1713.
Piper indicum aureum latum. Hort. Eyst., 1613, 1713.
Fig. in Hernandez. Nova Hisp., 1651, 137.
Piper indicum longioribus siliquis rubi. Swert., 1654, t. 35, f. 3.
Piper vulgatissime. Jonston, 1662, t. LVI.
Piper oblongum recurvis siliquis. Jonston, 1662, t. LVI.
Capsicum fructu conico albicante, per maturitatem miniato, Dill., 1774, t. 60.
Piment Jaune long. Vilm., 1883, 409.
Long Yellow Capsicum. Vilm., 1885, 151.

(*b.*) Fruit pendent; round.

Siliquastrum rotundum. Cam. Epit., 1586, 348.
Piper rotundum majus surrectum. Jonston, 1662, t. LVI. (as figured.)
Figure 5. Piso, 1658, 225.
Cherry Red, of some seedsmen.

(*c.*) Fruit erect; round.

Piper minimum siliquis rotundis. Hort. Eyst., 1613, 1713.
Capsicum cersasiforme. Fing., t. V.
Piment cerise. Vilm., 1883, 411.
Cherry Pepper. Burr, 1863, 621; Vilm., 1885, 152.
According to Sloane, l.c., this is the *axi rotundum* of P. Martyr, the *axi rotondo* of F. Colon, the *carive sive axi montense* of Laet, the *caribe* of J. Acosta, etc.

IV. Calyx funnel form, as large as base, but the fruit more or less irregularly swollen; not pointed; pendent.

Capsicum luteum. Lam. Fing., t. VIII.
Prince of Wales, of some seedsmen (yellow).
(Perhaps) *Capsicum latum Dodanæi.* Lugd., 1587, 632.
Capsicum latis siliquis. Dod., 1616, 717.
Capsicum siliquis latiore and rotundiore. J. Bauh, 1651, II., 943.

Piper capsicum siliqui latiori et rotundiore. Chabr., 1677, 297.

V. Calyx set in concavity of fruit.

This character is perhaps produced only by the swollen condition of the fruit as produced by selection and culture. As, however, it appears constant in our seedsmen's varieties, it may answer our purpose here.

(*a.*) Fruit very much flattened.

Piper indicum rotundum maximum. Hort. Eyst., 1613, 1713.

Solanum mordeus, etc., Bonnet Pepper. Pluk. Phyt., 1691, t. 227, p. 1.

Capsicum tetragonum, Fing., t. 10.

Piment tomato. Vilm., 1886, 413.

Red Tomato capsicum or American bonnet. Vilm., 1885, 154.

(*b.*) Fruit, squarish, angular, very much swollen, large.

This class includes the Bell, Sweet Mountain, Monstrous, Spanish mammoth, of Vilmorin; the Giant Emperor, Golden Dawn, etc., of American seedsmen. The varieties of this class seem referable to *Capsicum annuum rugulosum,* Fing., *C. grossum pomiforme,* Fing., and *C. angulosum,* Fing., but I have not as yet sufficiently studied them.

This class V. embraces the sweet peppers, and none other. A sweet kind is noted by Acosta [82] in 1604, and it is perhaps the *rocot uchu* of Peru, as mentioned by Garcilasso de la Vega.[83] Sweet peppers are also referred to by Piso [84] in 1648.

Occasionally *Capsicum baccatum* L. is grown, but the species is too southern for general use in the north. Its synonymy follows:

Capsicum, Piper indicum brevioribus siliquis. Lob. Obs., 1576, 172; ic., 1591, I., 317.

Capsicum brasilianum. Lugd., 1587, 633; Pancov., 1673, n. 297.

Capsicum minimis siliquis. Ger., 1597, 292; Dod., 1616, 717.

Piper siliqua parva brasilianum. J. Bauh., 1651, II., 944.

[82] Acosta. Hist., 1604, 266.
[83] Vega. Ray, Com., Hak. Soc. Ed., II., 365.
[84] Piso. Bras., 1648, 108.

Fig. 8. Piso, de Ind., 1658, 225.

Piperis capsici varietas, siliqua parva, etc. Chabr., 1677, 297.

Capsicum baccatum L. Fing., t. IV.

Small Red Cayenne. Briggs' Seed Cat., 1874.

I do not desire it to be understood that the classification used here is other than for convenience. It has no claims for scientific accuracy, as it is only based upon such garden varieties as are known to me, and not upon a complete study of the species of this genus. It will however suffice to show that no type of our modern varieties can be considered of recent origin, but that they are probably all derivatives from the ancient American culture.

The *pepper* or *capsicum* is called in France *piment, carive, corail des jardins, courats, poivre de Calicut, poivre d'Espagne, poivre de Guinee, poivre de Portugal, poivre d'Inde, poivre du Bresil, poivron;* in Germany, *pfeffer;* in Flanders and Holland, *spaansche peper;* in Italy, *peperone;* in Spain, *pimiento;* in Portugal, *pimento, pimentas.*[85]

[85] Vilmorin. Les. Pl. Pot., 408.

EDITORIAL.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

THE press has taken hold of a question of vital interest to the science of this country, which too many of the scientific men themselves have been unwilling to touch. The New York *Herald* of Sunday, the 12th Jan., contains an exposition of some abuses which have been for a long time an open secret among the geologists and paleontologists of the country. It is unfortunate for the reputation of some of our scientific men that they have neglected the matter so long that its adjudication has now passed into the hands of the public. The matter should have been quietly disposed of among themselves, but it has now gone before a wider tribunal, in which the susceptibilities of individuals will be less considered. The question of scientific honesty and scientific property is at stake, and it is strange that scientific men everywhere in the country have not perceived that the personal reputation of every scientific man in the country is involved in the toleration of a state of affairs such as is described in the above mentioned interview.

The facts are now well known. A wealthy man who desires to pursue a scientific career, finding the labor of doing so distasteful, and the solution of the questions involved inconveniently difficult, employs a number of "assistants." It turns out that these assistants are not only expected to do the mechanical and clerical work necessary to the pursuit of original research, but also to perform the research itself, and to commit the results to paper. The manuscript thus obtained is issued by a reputable scientific journal, and by the United States Geological Surveys, as the work of the employer of these assistants, his name appearing on the title page, and credit for the authorship of the published contents being assumed by him.

We do not hesitate to say (and in so doing we express the opinion of a majority of scientific men), that while this mode of advancing scientific knowledge may be successful, it is disreputable and fraudulent. However, it is probable that there is no

written law forbidding it, so that had this institution been content to remain a private one, it might have pursued its course for many years. But the reputation obtained in the manner above described, proved too impressive to be passed without special recognition. Between ignorance of the facts and pachydermatous consciences, the proprietor of the establishment which turned out such results was made president of the United States National Academy of Sciences. It became evident also that so worthy an adjunct in the advancement of science should have the recognition and financial aid of the United States. So the trader in brains became the paleontologist of the United States Geological Survey.

Both of these appointments do no credit to those who effected them. In the latter case the responsibility rests on a single man, the director of the Survey. The spectacle thus presented by two of the three leading scientific organizations of the United States Government, is one which should make every American blush.

Some work of the same kind as that produced by this establishment had been ordered by a previous congress, and the execution of it had been placed in the hands of the Geological Survey by the Secretary of the Interior. For eight years the Director of the Geological Survey has failed to carry out the orders of the Secretary, and the concurrent resolutions of Congress. To do so would be to anticipate some of the work of the new organization which had been adopted by the Survey. The man who hired others to do this work could not tolerate another man who did his own work so "near the throne." Besides, he could not do the work without the specimens used by his predecessor, the other man, and so he must get possession of them, although they are the private property of the latter. The materials on which the work ordered by Congress and the Secretary were to be based must be presented to the Government, and then the question of publishing the work would be considered! It is Naboth's Vineyard with two Ahabs. The modern Naboth, however, lived in the land of newspapers and of public opinion, and these have been heard from. Ahab has not yet obtained the vineyard.

—THE numbers of the NATURALIST for 1889 were issued (by the grace of the Leonard Scott Publication Co.) at the following

dates, so far as they have appeared. January, March 1st; February, May 31st; March, June 28th; April, August 15th; May, September 28th; June, December 1st; July, November 18th; August, January 5th, 1890; September, February 4th, 1890. The numbers for the present year, it is anticipated, will be issued on time.

RECENT LITERATURE.

"Challenger" Voyage.—W. P. Sladen's Asteroidea.[1]—The thirtieth volume of the Challenger Reports is a double one, consisting of 935 pages of text, and of 118 plates and a map. The report does not confine itself to the star fishes collected by the Challenger, but includes also those taken by the Lightning, Porcupine, Knight-Errant, and Triton. In the Challenger collection were 268 species belonging to 84 genera, and of these 184 forms are described as new. The total number of new species described in the work is 196, besides 15 forms that are considered as only varieties. Mr. Sladen reduces Perrier's 52 genera to 49, three of the genera proving invalid or synonymous, and the Challenger Expedition furnished examples of 38 of these previously known genera. So large a number of new genera have been described that the synoptic list of all known species of recent Asteroidea, given at the end of the Report, enumerates 137 genera and 810 species.

The long list of of abyssal Asteroids brought to light by the Challenger and other deep sea expeditions, has opened a new chapter in the history of the Asteroidea, and Mr. Sladen has attempted a classification upon a new basis, more in accordance with morphological characters than preceding ones. The fundamental points of structure selected by Mr. Sladen are: (1) those which adapt the organism for the functions of respiration and excretion; (2) the character of the ambulacral skeleton; and (3) that of the ambital skeleton.

For the first he chooses the organs called "papulæ" by Stimpson, transparent membranous cæca which penetrate the body wall, and permit an exchange by osmosis with the free fluid without. These papulæ may be confined to a limited area on the abactinal surface, never passing beyond the boundary of the supero-marginal plates (Ste-

[1] Voyage of H. M. S. Challenger. Report on the Asteroidea collected during 1873-76. By W. Percy Sladen, F.L.S., F.G.S. Vol. XXX. 1889.

nopneusia); or they may pass beyond this boundary, and occur upon the lateral walls and actinal surface (Adetopneusia). Mr. Sladen regards the former group as the more primitive, and states that the young of the second group pass through a stage which represents that of the adults of the first.

The production of the ambulacral element in some star-fishes is much more rapid than general growth, thus producing a crushing together of the plates in the direction of the length, in some cases carried to such an extent that the tube-feet in each furrow become quadriserial. This last character is not looked upon as of sufficient importance to define the primary subdivisions of the class. The group in which this ambulacral crowding occurs is called Leptostroteria, while the group in which ambulacral development proceeds *pari-passu* with that of other parts of the body, is the Eurystroteria, and is by Mr. Sladen considered the older. Embryology supports this view.

The ambital skeleton, formed of the marginal plates and their supplementaries, is looked upon as one of the most important systems of plates in determining form and superficial character. Here there are also two distinct modes of growth, that in which these plates increase rapidly, and continue to develop throughout the life of the star-fish (Phanerozonia), and that in which these plates do not increase in size, but, on the contrary, become relatively smaller as other parts increase (Cryptozonia). The Phanerozonia are regarded as the more primitive, especially as the young of a cryptozonate asteroid is phanerozonate.

Two orders of the Euasteroidea are thus formed, the one, Phanerozonia, combining also the stenopneusid and eurystroterid characters; while the other, Cryptozonia, combines the adetopneusid and leptostroterid characters. In the first order are placed the families Archasteridæ, Porcellanasteridæ, Astropectinidæ, Pentagonasteridæ, Anthenеidæ, Pentacerotidæ, Gymnasteriidæ, and Asterinidæ; while in the Cryptozonia are those of Linckiidæ, Zoroasteridæ, Stichasteridæ, Solasteridæ, Pterasteridæ, Echinasteridæ, Heliasteridæ, Asteriidæ, and Brisingidæ. The Asterinidæ, with their comparatively small marginal plates, approach the Linckiidæ, in which the plates are large for the group. Mr. Sladen's classification is certainly the clearest that has been as yet formulated, and it is cheering to note that its author views all classification as nothing more than a working key of our views of affinity.

Not less than 109 species and varieties were found at depths of from 500 to 2500 fathoms. In most cases the actinal and abactinal aspects of two to four species are given on one or more plates, and are succeeded by magnified details of the more important external characters.

RECENT BOOKS AND PAMPHLETS.

ALLEN, HARRISON.—The Anatomy of the Nasal Chambers. Reprint from the *New York Medical Journal*, Feb., 1889. From the author.

BAUR, G.—Paleohatteria Credner and the Proganosauria. Extract from the *Am. Journ. of Science*, Vol. XXXVII., April, 1889. From the author.

BLYTT, A.—On Variations of Climate in the Course of Time. Reprint from Christiana *Videnskabs-Selskabs Forhandlinger* 1886, No. 8. From the author.

BOETTGER, O.—Ein neue Pelobates aus Syrien. Separatabdruck aus dem *Zoologischen Anzeiger*, No. 302, 1889. From the author.

BOULE, MARCELLIN.—Les Prédécesseurs de nos Canidés. From the author.

CLARKE, F. W.—Report of Work Done in the Division of Chemistry, 1885–86. Bull. of U. S. Geol. Survey, No. 42. From Department of the Interior.

DÖDERLEIN, L.—Das Skelet von Pleuracanthus. Separatabdruck aus dem *Zoologischen Anzeiger*, No. 301, 1889. From the author.

DUMBLE, E. T.—Texas Geological and Mineralogical Survey, 1888. From W. T. Cummins.

ECCLES, R. G.—Descent and Disease. Reprint from the *Brooklyn Medical Journ.*, Feb., 1889. From the author.

EVERHART, EDGAR.—Infant Food. Read before the Texas State Geol. and Scientific Ass., May 17, 1887. From the author.

FRENZENY, P.—The Bucking Horse. From the author.

GARMAN, H.—On the Anatomy and Histology of a New Earth Worm (*Diplocardia communis*). Extract from Bull. Illinois State Laboratory of Nat. Hist., Vol. III. From the author.

GEGENBAUR, C.—Über die Occipital Region und die ihr Benachbarten Wirbel der Fische. From the author.

HALE, HORATIO.—The Development of Language. Reprint from Proceedings of Canadian Institute, Vol. VI. From the author.

HIGLEY, W. K.—Reptilia and Batrachia of Wisconsin. Reprint from Vol. VII. of the Trans. of Wis. Acad. of Sciences, Arts and Letters. From the author.

HOUGH, WALTER.—An Esquimo Strike-a-Light from Cape Bathurst, British Am. Extract from the Proceedings U. S. National Museum, Vol. XI., 1889. From the author.

HOWES, G. B. and A. M. DAVIS.—Observations upon the Morphology and Genesis of Supernumary Phalanges, with especial reference to those of the Amphibia. Extract from the Proceedings of the Zool. Soc. of London, Dec. 4, 1888. From the author.

IRELAND, WM.—Eighth Annual Report of the State Mineralogist for the year ending Oct. 1, 1888. From the author.

KÜNTZ, GEORGE.—On Two New Masses of Meteoric Iron.—Mineralogical Notes. Extracts from *Am. Journ. Science*, Vol. XXXVI., 1888.—Precious Stones. Abstract from Mineral Resources of U. S. Calendar, 1887. Meteoric Iron from Arkansas, 1886. Extract from U. S. Nat. Museum, Vol. X. From the author.

LAWRENCE, G. N.—Remarks upon Abnormal Coloring of Plumage Observed in Several Species of Birds. Extract from *The Auk*, Vol. VI., Jan., 1889. From the author.

LECHE, WILHELM.—Uber Einen Jungen Menschlichen Embryo. Biologiska Föreningens Förhandlinger, Verhandlungen des Biologischen Vereins in Stockholm, Band I., Mars., 1889, No. 6. From the author.

LINTNER, J. A.—Cut-worms. Bull. of the New York State Museum of Natural History, No. 6, Nov., 1888. From the author.

MANIGAULT, G. E.—On the Probable Source of the Phosphorus in the South Carolina Phosphates. Proceedings of the Elliott Society. From the author.

MEYER, OTTO.—List of Scientific Publications (printed as manuscript). From the author.

MEYER, OTTO, and SAMUEL PENFIELD.—Results Obtained by Etching a Sphere and Crystals of Quartz with Hydrofluoric Acid. Report from Trans. Conn. Acad., Vol. VIII., 1889. From the authors.

NASON, F. L.—New York Minerals and their Locality. Bull. New York State Museum of Nat. Hist., No. 4, August, 1888. From the author.

NEWTON, E. T.—On the Skull, Brain, and Auditory Organ of a New Species of Pterosaurian (*Scaphognathus purdoni*), from the Upper Lias, near Whitby, Yorkshire. Extract from Philosophical Trans. Roy. Soc. London, Vol. 179 (1888), B. From the author.

PHILLIPS, HENRY.—Subject Register and Supplemental Index of Papers Published in the Trans. and Proc. of the Am. Philosophical Soc. From the compiler.

POHLIG, HANS.—Sur la Structure de la Coquille des Discina. Extrait du Bull. de la Société Belge de Geologie, Tome II., 1888. From the author.

RILEY, C. V.—The Hessian Fly an Imported Insect. Extract from the *Canadian Entomologist*, Vol. XX. From the auhor.

RILEY, C. V.—Poisonous Insects. Extract from the Reference Handbook of the Medical Sciences, Vol. V., 1887. From the author.

SEELEY, H. G.—On *Pareiasaurus bombidens* (Owen), and the Significance of its Affinities to Amphibians, Reptiles, and Mammals.—On Parts of the Skeleton of a Mammal from Triassic Rocks of Klipfontein, Fraserberg, South Africa, illustrating the Reptilian Inheritance in the Mammalian Hand. Extract from Philosophical Trans. of the Roy. Soc. of London, Vol. 179 (1888), B. From the author.

SHUFELDT, R. W.—Comparative Data from 2,000 Indian Crania in the the U. S. Army Medical Museum. Reprint from the *Jour. of Anat. and Physiology*, Vol. XXII. From the author.

SMITH, E. F.—Peach Yellows. A Preliminary Report, Bull. No. 9, Department of Agriculture. From J. M. Rusk.

SPENCER, J. W.—Glacial Erosion in Norway and High Latitudes. Extract from Trans. Roy. Soc. Canada. From the author.

TRAQUAIR, R. H.—Notes on *Chondrosteus acipenseroides* (Agassiz). Extract from the *Geol. Mag.*, June, 1887. From the author.

TOPINARD, M. P.—Les Dernières Etapes de la Généalogie de l'Homme. Extrait de la *Revue d'Anthropologie* du mois de Mai, 1888. De l'auteur.

VASEY, GEORGE and B. T. GALLOWAY.—A Record of Some Work of the Division. Bull. No. 8, U. S. Department of Agriculture. From Norman Coleman.

WHITEAVES, J. F.—On Some Cretaceous Fossils from British Columbia, the Northwest Terr. and Manitoba. Extract from Geol. and Nat. Hist. Survey of Canada. From the author.

WHITMAN, C. O.—First Annual Report of the Marine Biological Laboratory, 1888. From the Director.

WIEDERSHEIM, R.—Zur Urgeschichte des Beckens. Besonderer Abdruck aus den Gesellschaft zu Freiburg i. B., Band IV., Heft 3.

WILLIS, BAILEY.—Changes in River Courses in Washington Territory due to Glaciation. Bull. of U. S. Geological Survey No. 41. From the Department of the Interior.

WILLIAMS, H. S.—On the Fossil Faunas of the Upper Devonian—The Genesee Section, New York. Bull. of the U. S. Geol. Survey, No. 41. From the Department of the Interior.

WINCHELL, ALEX.—Conglomerates Enclosed in Gneissic Terranes. Reprint from *The Am. Geol.*, March, 1889. From the author.

WOLTERSTORFF, W. VON—Die Amphibien Westpreusses. Separatabdruck aus den Schriften der Naturforschenden Gesellschaft in Dantzig. N. F. VII., Bd. 2, Heft, 1889. From the author.

WOODWARD, A. S.—A Comparison of the Cretaceous Fish-fauna of Mt. Lebanon with that of the English Chalks. Extract from the *Ann. and Mag. of Nat. Hist.*, Oct., 1888. From the author.

General Notes.

GEOLOGY AND PALEONTOLOGY.

The Tertiary and Cretaceous of Alabama.[1]—The long sections furnished by the rivers of Alabama, have been the principal sources of our knowledge of the Cenozoic and Mesozoic geology of that State, and it is to Professor Eugene Smith, of Tuscaloosa, that we are indebted for the greater part of our recent knowledge of the subject. He gives the following synopsis of the formations included in the memoir:

Tertiary, Eocene)	Upper.	White Limestone.	Coral Limestone (?Vicksburg),	150
			Vicksburg (Oolitoidal),	140
			Jackson,	65
	Middle.	Claiborne,		140–145
		Buhrstone,		300
	Lower.	Lignitic.	Hatchetigbee,	170
			Wood's Bluff,	80–85
			Belle's Landing	140
			Nanafalia,	200
			Matthew's Landing and Naheola,	130–150
			Black Bluff,	100
			Midway,	25
Cretaceous.	Ripley,			250–275
	Rotten Limestone,			1000
	Eutaw,			300
? Cretaceous.	Tuscaloosa,			? 1000
				424

The Tuscaloosa formation (McGee) is of uncertain age, some reasons for placing it within the Jurassic system having been adduced. This is the formation which has described by some of the geologists of the U. S. Geological Survey under the name of Potomac. Mr. McGee's name, having priority by many years, must be adopted.

[1] On the Tertiary and Cretaceous Strata of the Tuscaloosa, Tombigbee and Alabama Rivers; by Eugene A. Smith and Lawrence C. Johnson. Bulletin U. S. Geological Survey, 1887, No. 43.

The report concludes as follows (p. 138): "Thus our preliminary observations suggest the movements, and in some cases the positions, of the Cenozoic and Mesozoic shore-lines, and enable us to say that the breaks in stratigraphic and paleontologic continuity in these formations are apparent rather than real, and are due to simple and readily determinate continental movements."

Professor Smith has for many years studied and reported on the geology of Alabama, largely at his own expense. He had already planned and partly finished the explorations recorded in this report, when the U. S. Geological Survey, in the face of promises made by the director to the contrary, sent a new and inexperienced man to do the same work; a highly improper proceeding, whether viewed from the standpoint of justice or of economy. The result is the double authorship which appears on the title page, although the work was really done by Smith, Langdon and Aldrich. The only part of the report in which the views of Professor Smith were not adopted is the coloration of the geological map (p. 134). Here the Mesozoic and Cenozoic beds are colored with tints employed by all other geologists for certain paleozoic formations, in accordance with the method adopted by the present U. S. Geological Survey. This system, which reverses the coloration at present in use by other civilized nations, has no reason for existence, and has already received the condemnation of all disinterested critics. Professor Smith will issue a copy of the map with the conventional colors at some future day.

The memoir is illustrated by a large number of process-cuts of good quality.

A. Smith Woodward on Cœlorhynchus[1] Agassiz.—Among the most interesting of undetermined Ichthyodorulites are some straight, long, slender, round, ribbed spines, met with in the Upper Cretaceous and Tertiaries, and originally described by Agassiz as the rostral bones of sword-fishes under the names of Cœlorhyncus. Their dermal nature was first pointed out by Williamson, who published a detailed microscopical description; and the fragments of the fossil have since been recognized from various parts of the world.

It seems evident that Cœlorhynchus is the spine of a cartilaginous fish, that probably occupied a forward position upon the back; and, if the interpretation of Mr. Willett's fossil be correct, the genus must pertain either to the sharks or to the Chimæroids. The microscopical structure of the fossil accords with this supposition, although some-

[1] *Annals and Magazine of Natural History*, September, 1888.

what anomalous, and as the dorsal spines in no true shark are destitute of a smooth inserted base, Mr. Woodward refers the fish provisionally to the Chimæroids. The extinct members of the latter order do not all possess dorsal spines of the normal type observed in the living Chimæra, as shown by Dr. von Zittel's Chimæropsis; and the possibility of the problematical spines under discussion pertaining to the same group is thus rendered more worthy of consideration. In any case the name Cœlorhynchus is obviously inappropriate, as well remarked by Williamson; but it has yet to be determined whether the dentition of the same fish has not already become known under some other suitable generic title.

Geological News.—Paleozoic.—R. H. Traquair (*Geol. Mag.*, Jan., 1889) compares Homosteus Asmuss, Asterolepis Hugh Miller, with Coccosteus Agassiz. The dorsal plates of the two genera correspond closely, but no undoubted remains of a ventral carapace of Homosteus have yet been found.

J. W. Gregory describes in the January number of the *Geological Magazine* a new species of Protaster from the Upper Silurian of Victoria, Australia.

Turrilepas, Woodward, first described from the Wenlock limestone and shale of Dudley (England), has been found by Mr. Arvi in the Utica formation of Ottawa, Canada. This cirripede has four rows of asymmetrical plates, with more than eight plates in a row.

Echinocaris whidbornei and *Beyrichia devonica* are added to Devonian fossils by Prof. T. R. Jones and Dr. H. Woodward. Both are Entomostraca. (*Geol. Mag.*, Sept., 1889.)

Mr. R. Etheridge has sent forth a catalogue of the fossils of the British Islands, stratigraphically and zoologically arranged. The first volume contains the paleozoic forms. In the preface to his catalogue Mr. Etheridge gives some interesting figures. In 1822, only 752 extinct species of all classes in the animal and vegetable kingdoms were known and described. In 1854, 1,280 genera and 4,000 species were catalogued by Prof. J. Morris; at the close of 1874, 13,300 forms had been described, and for the most part figured; and now the census of the British Fossil Fauna and Flora comprises 3,750 genera and 18,000 species, all recorded in monographs and serial works. The species included in this volume, ranging from the Cambrian to the close of the Permian, amount to 6,022, and are included in 1,588 genera.

Devonian.—In the transactions of the New York Academy of Science, Prof. Newberry publishes a brief description of a series of fossil fish from the lenticular calcareous concretions in the top of the Erie shale in the Valley of the Cuyahoga, near Cleveland, Ohio.

1. *Cladodus* n. sp., a shark six feet or more in length, and with a diameter of body of about eight inches.

2. Actinophorus, nov. gen., a long slender ganoid, and *Actinophorus clarkii*, n. sp., a slender fish about two feet in length by two and a half inches diameter at the pectoral fins.

3. *Dinichthys curtus;* of medium size.

4. *Dinichthys terrelli* (*?*) Newb.

5. *Dinichthys tuberculatus*, n. sp.

At a meeting of the New York Academy of Sciences, April 16, 1888, Professor Newberry described at length a species of Rhizodus found in the mountain limestone at Alton, Ill., which evidently represents a species of Rhizodus much like *R. hibberti* Ag., which he named *R. anceps*.

Mesozoic.—Mr. R. Lydekker describes and figures in the September issue of the *Geological Magazine* an imperfect left pectoral paddle of *Ichthyosaurus intermedius* showing traces of the integuments. Such specimens are very rare.

The British Museum has recently acquired a remarkably well-preserved female specimen of *Rhinobatus bugesiacus*, the gigantic ray from the lithographic shales of Bavaria. It is about five feet long, and complete in all important respects.—*Geol. Mag.*, Sept., 1889.

M. A. F. Mariori describes *Deliostrobus sternbergii*, a new genus of Tertiary Coniferæ.—*Ann. Sci. Geologiques*, 1889.

Mr. J. Carter, in describing *Palæga mccoyi* (*Geol. Mag.*, May, 1889) states that up to date scarcely thirty fossil species of Isopoda are known to science. The new species occurs in the Cambridge upper greensand.

A new form of Pinna, another of Prodromus, and the echinid *Eodiadema granulata*, are added to the fossils of the Lias by Mr. E. Wilson and W. D. Crick.—*Geol. Mag.*, July, 1889.

According to *Petermann's Mitteilungen*, Prof. A. Wichmann found upon the small island of Saniamo, off the coast of Timor, numerous mud volcanoes; and on that of Rotti, at the southwest end of Timor, he discovered, in two mud volcanoes, some ammonites and belemnites, the first Jurassic fossils yet found in the archipelago.

Dr. Rüst (Palæontographia, 1888,) describes the radiolarians that have been found in Cretaceous strata. In Germany these organisms are very abundant in some of the lower beds, though scarce in the higher. From the Cretaceous and Jurassic of Germany 165 species, in 74 genera, are now known.

Cretaceous.—Smith A. Woodward has published a Synopsis of the Vertebrate Fossils of the English Chalk. As a result of observation and comparison, he gives fifteen species of Reptilia, and eighteen Pisces. Of the latter, twenty-three belong to the order Selachii, eight to the Chimæroidei, twelve to the Ganoidei, thirty-six to the Teleostei, and two doubtful.

M. Paul Levy (*Ann. Sci. Geo.*, 1889) contributes a memoir upon the phosphates of France and other countries, including an account of recently discovered beds, and notes upon their uses in agriculture, and their assimilation by plants. Phosphates occur in the oldest rocks, in sedimentry strata, and in metamorphic beds. They have been found in the Archean of Canada, in Estremadura (Spain), in Norway, at Caylux, Lot, etc., in France; in all these cases under the form of apatite. The beds most worked in France are the Lias, lower Cretaceous, and upper beds of the Mesozoic era. M. Levy believes that the infiltrating water which has separated the phosphates from the carbonates is of interior origin, and has worked from below upwards, and in this belief he differs from many geologists, both French and English. The excavations made in the chalk by the waters have, in M. Levy's opinion, been filled by the descent of superior beds.

M. H. Lasne has contributed to the Annals des Sciences Geologiques for the current year a description of the geology of the department of Indre, with a map showing the geological structure. This region, which furnishes abundant phosphates, is interesting from the number of stages that can be observed in a limited space. There are ancient and eruptive crystalline rocks, Triassic and Rhaetic, Sinemurian, and Lias (rich in vertebrates and molluscs). The phosphates of the Lias of this department are in reality composed of fluo-phosphate of a composition identical with that of apatite—$CaFl_3$ (P_5, $3CaO$). He assumes that these materials were dissolved in the Liassic sea, and were deposited at the same time with the carbonate of lime by the departure of the carbonic acid. Above the phosphate-bearing Lias lie the Toarcian, Bajocian, and Bathonian, and Tertiary strata of Eocene and Miocene date, as well as in some places Pleistocene beds.

The first volume of a Catalogue of the Fossil Fishes in the British Museum, by Mr. A. S. Woodward, has recently been issued. It contains nearly five hundred pages, 17 plates and 15 wood-cuts, and is really a systematic work upon the extinct Elasmobranch fishes. These fishes are divided into the two orders Ichthyotomi (Cope) and Selachii. In the former are included the families Pleuracanthidæ and Cladodontidæ. Thirteen generic names are grouped in the genus Pleuracanthus. The Spinacidæ are classed with the Tectospondyli, or concentric suborder of the Selachii, which has twelve families, while the Asterospondyli, or radiate suborder, has but six.

The first part of a catalogue of the fossil Cephalopoda of the British Museum, with 344 pages and fifty-one wood-cuts, is the work of A. H. Foord, F.G.S. The present volume embraces the seven families Orthoceratidæ, Endoceratidæ, Actinoceratidæ, Gomphoceratidæ, Ascoceratidæ, Potioceratidæ, and Cyrtoceratidæ, which all together are but a part of the sub-order Nautiloida.

Jurassic.—R. Lydekker (*Geological Magazine*, Decade III., Vol. VI., No. 297, p. 119, March, 1889) describes two vertebræ from the Wealden of the Isle of Wight. These specimens clearly indicate a small Dinosaur allied to the genus Cœlophysis.

Cenozoic.—M. Forsyth Major has sent to the *Comptes Rendus* an account of a bed of fossil bones discovered in Samos, and of Lower Pliocene age. Among the mammals are many specifically identical with those of Pikermi, in Attica, Baltavar, in Hungary, and Maragha, in Persia; but there are also some new types, among them an Orycteropus. the only species yet known outside of the Ethiopian region; a large pangolin, estimated to be nearly three times the size of the West Africa *Manis gigantea;* and a ruminant referred by the author to the Giraffidæ, and stated to connect Helladotherium with the existing giraffe. There is also a large ostrich.

E. T. Newton describes (*Geol. Mag.*, Jan. 7, 1889) *Clupea vectensis* from the Ogliocene strata of the Isle of Wight.

Prof. W. Dames has described in the Proceedings of the Berlin Society of Natural Sciences a new kind of sawfish from the Eocene of Birket-et-Qurun, in Egypt. The rostral teeth of this *Amblypristis cheops* differ from those of the existing Pristis in their shortness and great relative breadth.

The Marquis G. de Saporta (*Annales des Sciences Geologiques*, 1889,) contributes an article upon the fossil plants of Aix, in Provence, studied stratigraphically and paleontologically. The plates illustrative of the shells of the Aix group accompany the memoir.

Additions to the vertebrate fauna of the Preglacial Forest Bed of the Norfolk coast increase through the rapid denudation carried on by the North Sea, and Mr. E. T. Newton has in the April issue of the *Geological Magazine* described *Cervus rectus* n.sp., and recognised the presence of *Bison bonasus*, *Phoca barbata*, the narwhal, the beluga and the porpoise.

H. H. Howorth, M. P. (*Geol. Mag.*, July, 1889) states his belief that in the mammoth age the Arctic Ocean either did not exist, or was very small, the greater portion of its area being occupied by land upon which trees would grow. The continents would therefore be united by land, and an ample bridge provided. This land area would partially account for the warmer climate.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—In his report on the geology of the Rainy Lake region, Dr. Lawson[2] gives a petrographical description of the rocks comprising the Laurentian, Coutchiching and Keewatin groups in the neighborhood of the above-named lake in Canada. The rocks of the Keewatin series are principally bedded traps and greenstones, altered from traps by metasomatic and dynamic metamorphism, and greenstones of clastic origin, hornblende schists and other foliated rocks. The effect of pressure is shown in the broken condition of many of the crystals in the rocks; crushed and sundered plagioclase, apatite, hornblende, leucoxene, tourmaline and quartz are all described and figured. Between the hornblende schists and the Laurentian gneisses the author recognizes phenomena which he believes to be due to contact action. If this supposition is found to be a correct one, the fact affords a striking confirmation of the view that the gneisses under the

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Geol. and Nat. Hist. Surv. of Canada. Annual Report for 1887. Pt. F.

Keewatin are of eruptive origin. The Coutchiching series embraces mica-schists and other lighter colored schistose rocks between the lowest members of which and the gneisses are also evidences of contact action. Among the lighter schists are granulites and sericite-porphyroids. In the Laurentian a hornblende-syenite gneiss occurs, and in it several pieces of twinned sphene were observed.——The two craters Mte. Cimino and the Lago di Vico [3] in central Italy, though but parts of the same great volcano, like Mts. Somma and Vesuvius, have during their different periods erupted different kinds of lava. The lavas of Cimino have an andesitic habit. They are to be classed with the mica and augite andesites, the latter of which contain porphyritic sanidine and olivine. The younger crater, Lago di Vico, has poured forth leucite bearing rocks, of which leucitophyre, leucite-tephrite, leucite-basanite and phonolites are the prevalent types. A leucite-trachyte, placed by Rosenbusch among the phonolites, is the latest lava of the older crater. It is an intermediate type between the predominant lavas of Cimino and those of the later Lago di Vico. Besides the lavas, the former crater cast forth sanidnite bombs and calc-silicate bombs, containing garnets and vesuvianite.——In a brochure on the Obere Weilerthal, E. Cohen [4] gives an interesting account of the eruptive and sedimentary rocks occurring in the Weilerthal south of the rocks made famous by Rosenbusch under the name Steigerschiefer. Those described by Cohen are granite, gneiss, quartzite-schists, phyllites, granite, porphyry, augite porphyry and minettes. In the granite is a brown hornblende in prismatic crystals. Their specific gravity varies between 3.082 and 3.140, and their composition is as follows:

	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	H_2O
Darker var.	51.36	4.14	2.17	10.04	11.91	17.14	1.86	1.38
Lighter var.	51.82	4.17	2.34	9.84	12.18	17.18	1.34	1.13

Many of the other rocks described present interesting features, but none of great petrographical importance.——An examination [5] of the northern slopes of Cader Idris, Merionethshire, Wales, discloses interbedded slates, tuffs, and massive eruptive rocks of considerable interest. Among the sedimentary rocks is the well-known pisolitic ironstone, in which the pisolitic structure is now represented by magnetite crystals in a cement of green iron silicate. This structure was originally pro-

[3] W. Deecke, *Neues Jahrb. für Min.*, B. B. VI., 1889, p. 205.

[4] Abh. zur Geol. Specialk. v. Elsass-Lothringen, B. III., H. III., p. 137.

[5] *Quar. Journ. Geol. Soc.*, August, 1889, p. 432.

duced by the tendency of some carbonate to form concretionary masses around grains of sand or small shells. The original carbonate has for the most part disappeared, leaving the magnetite as a pseudomorph. Among the eruptives is a rock that the author calls eurite, following d'Aubuisson,[6] although it would seem that the name quartz-keratophyre would sufficiently well characterize it. The rock is a bluish-gray compact substance with a specific gravity of 2.64. It contains quartz and feldspar crystals, wisps of biotite and spherulites of granophyre, more particularly around the porphyritic crystals, in a groundmass composed principally of a chloritic substance. Its analysis shows it to contain a soda-rich feldspar:

SiO_2	Al_2O_3	Fe_2O_3	MnO	CaO	MgO	K_2O	Na_2O	Loss
72.79	13.79	3.32	tr.	1.94	.62	2.99	4.12	1.08

——In his description of the section Tanneberg of the geological map of Saxony, Dalmer[7] mentions two rocks of some interest. The first is a sericite-gneiss, composed of quartz, plagioclase and sericite, with a breccia-like structure produced by pressure. The quartz and plagioclase are shattered, and the broken pieces are reunited by a cement of secondary quartz and sericite. The second is a chlorite-gneiss, consisting of orthoclase, albite, chlorite and quartz. This occurs in varieties of different degrees of coarseness. As it becomes finer in grain it loses feldspar, and assumes muscovite, until finally it approaches in structure and composition the phyllites of the region.——Kendall[8] gives a list of the basic dykes on the island of Mull that contain the glassy selvages known as tachylite. It has been observed that the thickness of this glass band is always greatest in that portian of the dyke in contact with the most compact rock. A new type of tachylite, called by Groom[9] carrockite, is associated with gabbro at Carrock Fell in the Lake District, England. It consists of a green glass enclosing spherules of quartz, feldspar, and granular aggregates of augite, and porphyritic crystals of the same minerals.—Prof. Bonney[10] has examined certain banded micaceous schists from Morlaix, Brittany, which he thinks are the result of pressure and contact action. The rocks were originally stratified sands and muds, that were crumpled and foliated by pressure, and in which a light and a dark mica, chiastolite and andalusite were developed. By the subsequent intrusion of gran-

[6] Traité de Geognosie, 1819, p, 117.
[7] Erl. z. Geol. Specialk. des Königr. Sachsen Blatt, 64.,
[8] *Geol. Mag.*, Dec., 1888, p. 555.
[9] *Geol. Mag.*, Jan., 1889, p. 43.
[10] *Quart. Jour. Geol. Soc.*, Feb., 1888, p. 11.

ite all traces of their fragmental origin were obliterated; the rock became crystalline, and a few additional minerals were produced.——The first occurrence of glaucophane as a consitutent of British rocks is noted by Blake[11] in an altered diorite from a quarry near the Anglesea Monument, Anglesea. The rocks consists of chloritized glaucophane, grains of epidote, a rutile quartz and calcite. The glaucophane is present in elongated prisms, which form a felt around epidote, and are included in the quartz.

Mineralogical News.—*Morphological and Physical Properties.*—The possibility of the selection of half the planes of the monoclinic hemi-pyramid in such a way as to fulfill the conditions of hemihedrism has been shown by Williams.[12] If two of the planes intersecting in the plane of symmetry be allowed to develop to the exclusion of the other two, there results an apparent hemimorphism, which in reality satisfies all the conditions of hemihedrism. The monoclinic plane of symmetry remains, so that the character of the hemihedrism is the inclined-faced. Planes belonging to this hemihedral form are exhibited in pyroxene from Piedmont, Orange, and St. Lawrence counties, N. Y., and from Canaan, Conn. The habit is always hemimorphic.——In a recent paper Mügge[13] records some interesting observations on parting planes in several minerals. He describes rutile from the Urals in which the usual cleavage parallel to $\infty P\infty$, is wanting, its place being taken by a parting parallel to $\frac{2}{3} P\infty$, but whether as a result of twinning or not, Mügge is unable to decide. The author thinks that this variety of rutile is identical with the mineral from Polk county, N. C., described by Des Cloizeaux[14] as a dimorphous form of rutile. A garnet from Arendal, Norway, possesses cleavages parallel to the dodecahedral face, and contains acicular inclusions of cyanite with their $\infty P\bar{\infty}$ faces parallel to the ∞O faces of the garnet, and their *c* axes parallel to the edges of these faces. The mineral occurs in a schistose dioritic rock whose hornblende constituent has a well-developed parting parallel to $P\bar{\infty}$. Parting parallel to an octahedral face, in many members of the spinel group, is declared to be the result of polysynthetic twinning. Calcite, with a parting parallel to $\infty P2$, galena with twinning lamellæ parallel to $4O$, and breunerite, with $-2R\ 2R$ as the twinning plane, are also mentioned.——Boracite from

[11] *Geol. Mag.*, 1888, p. 125.

[12] *Amer Jour. Sci.*, Aug. 1889, p. 115. Cf. AMER. NATURALIST, Nov. 1887, p. 1025.

[13] *Neues Jahrb. f. Min.*, etc., 1889, I., p. 231.

[14] *Bull. Soc. franc., d. Min.*, IX., 1886, p. 184.

Lüneburg, Hanover, contains the new planes $\infty O\frac{5}{3}$, $\infty O1\frac{3}{8}$, $\infty O1\frac{7}{8}$. ——Beginning with the Le Bel and Van t' Hoff theory with regard to the connection between the structure of the molecule (*i. e.*, the arrangement of the atoms within the molecule) and the activity of circularly polarizing substances, and applying the principles of this theory to the Sohacke-Wulff[15] theory of crystal structure, Becke[16] is forced to conclude that this theory of crystallization is not satisfactory, since it does not account sufficiently well for the close relation that exists between the crystallization of a body and its chemical nature. Becke thinks that the symmetry of crystals is intimately dependent upon the symmetry of arrangement of the atoms within the molecules. If this be true, all circularly polarizing bodies should possess an unsymmetrical molecule, which should reveal itself through the unsymmetrical character of its crystallization. Becke publishes a list of all the circularly polarizing substances known, and discusses in detail the crystallization of grape sugar, since this has been regarded as a triclinic substance, without evidence of hemimorphism or hemihedrism—the only two modes of crystallization that can yield enantiomorphous, *i. e.*, unsymmetrical figures. As a result of measurements of crystals of pure sugar, Becke concludes that it is monoclinic with $a : b : c = 1.735 : 1 : 1.908$. $\beta = 97° 59'$, and hemimorphic in the direction of the c axis (really hemihedral, as indicated by Williams, ref. above). It is therefore enantiomorphous. The symmetry of its form corresponds with that of other circularly polarizing bodies, and corresponds also with the unsymmetrical structure of its chemical molecule, shown by recent synthetical methods. Two of these unsymmetrical molecules may be so arranged as to yield a crystal with one plane of symmetry (holohedrally developed monoclinic form), and four to produce forms with three planes of symmetry (orthorhombic forms). The symmetry of crystal forms thus depends primarily upon the distribution of the atoms within the molecule, Von Goldschmidt,[17] carrying out this idea more fully, attempts to simplify the discussion of the chemical relations of the silicates by making certain assumptions with regard to the conditions necessary to the mixture of molecules in groups of isomorphous silicates. He regards the particles as the primary constituent of the molecule, just as the atoms are the constituent parts of the molecule. Chemistry he defines as relating to molecules and their composing atoms; crystallography as relating to crystals and their composing particles. Isomorphism is the

[15] AMERICAN NATURALIST, 1889, p. 221.

[16] *Min. u. Petrog. Mitth.*, 1889, p. 464.

capacity of analogous particles to form similar crystals. Similar or analogous particles are those built on the same plan, though different in composition. Starting with these general ideas the author discusses the character of the particles forming the silicates, and concludes by applying his deductions to the explanation of the formulas of the most important silicates.——The examination [18] of senarmontite crystals in thin sections parallel to the cubic, octahedral and dodecahedral faces, shows that the apparently simple crystals are combinations of six orthorhombic crystals, and that the optical anomalies so frequently observed in the mineral are due to this intergrowth, or to twinning. Unlike the double refraction of some other apparently regular minerals, the anomalous action of senarmontite is not in the least affected in a temperature as high as 360°.——Mügge [19] has reinvestigated the subject of pressure twinning in sphene, and finds the twinning plane to be in the zone between ∞P and —P (DesCloizeaux's position), and not to coincide exactly with —2P, as determined by Williams. He ascribes the striations frequently observed in the sphene of plutonic rocks to pressure, but is not able to produce them by artificial means. ——As a result of measurements made in crystals of zinc obtained by slow distillation of the metal in a vacuum, Williams and Burton[21] have calculated the axial ratio to be $a : c = 1 : 1.3564$. The crystals are hexagonal, with a probable rhombohedral symmetry, and isomorphous with arsenic, antimony, bismuth, and tellurium.——In the pyroxene from Pinzgauer, Cathrein [22] has discovered the forms $\frac{3}{2}P\overline{\infty}$, $P\frac{1}{4}$, $\frac{1}{8}P\frac{1}{2}$, all of which are new to the species. In amethyst from the Zillerthal he has found the new planes

$$\frac{7}{8}R, ++\frac{P\frac{12}{11}}{4} \text{ r. l., } +\frac{\frac{9}{10}P\frac{9}{8}}{4}r, \text{ and } \frac{\frac{9}{8}P\frac{9}{7}}{4}l$$

while the forms most common to the mineral are absent.——The new plane $\frac{7}{16}P$ is recorded by Cèsaro [23] as occuring on topaz from Saxony.

Miscellaneous.—Retgers [24] has made a careful examination of the heavy solutions used for separating rock constituents with the endeavor

[17] *Zeitschrift. für Min.*, XVII., p. 25.

[18] Prendel, *Min. u. Petrog. Mitth.* XI., p. 7.

[19] *Neues Jahrb. f. Min.*, etc., 1889, II., p. 89.

[21] *Amer. Chem. Jour.*, XI., p. 219.

[22] *Zeits. f. Kryst.*, XVII., 1889, p. 19.

[23] *Bull. Soc. Franc. de Min.*, XII., p. 419.

[24] *Neues Jahrb. f. Min.*, 1889, II., p. 185.

to obtain modifications with a specific gravity greater than 3.6. His investigations result in the discovery that methylene-iodide will dissolve iodine and iodoform, and yield a liquid with the density of 3.6. For separating minerals with a greater density than this, he suggests the use of fused silver nitrate. At 198°, this salt melts to a colorless liquid, with the density 4.1. A mixture of the nitrate and iodide of this metal give a yellow oily liquid at a temperature of 65°–70°, whose specific gravity (5) is greater than that of any other substance, that has yet been proposed for the purpose desired. The author declares that these liquids serve as convenient means for separating the heavier minerals of rocks, and he gives directions for manipulating them.——The origin of most of the siliceous sinter deposited by the geysers in the Yellowstone Park is stated by Mr. Weed[25] to be due to a secretion of silica by algæ and mosses. Waters too poor in silica to form deposits of this substance by cooling or evaporation, are often dammed back by thick jelly-like accumulations of silica, separated from the water by plant life, which is quite abundant in some of the hot springs. The geyserites and similar bodies are produced by evaporation.

[25] *Amer. Jour. Sci.*, May, 1889, p. 351.

BOTANY.[1]

Peridial Cell Characters in the Classification of the Uredineæ.—In the genus *Roestelia* peridial cell characters are frequently given considerable prominence, and surely frequently add to the certainty of our identification. The question then naturally arises, why are not such characters valuable in the related genus *Æcidium*, where if anywhere in the *Uredineæ* we need all possible characters for certainty in identification.

The characters most frequently used are position and size of æcidia, size and outward appearance of spores, and most important of all, on what host plant. All are very variable, even the latter and most important one, many rusts sometimes occurring on the same host, and frequently the same rust on many hosts. The position—hypoplyllous, amphigenous, or epiphyllous—is changeable, determined, I think, largely by the character of the leaf, as I have shown elsewhere. The size of the æcidia varies also with a change of host-plant and immediate conditions of moisture and heat, as do also the æcidiospores.

What are the peridial cells? They are very likely, as usually supposed, slightly modified chains of æcidiospores loosely attached into a surrounding pseudo tissue layer for protection. This is readily believed when we observe that the peridial cells usually partake, more or less of the character of the æcidiospores, in shape, thickness of wall, roughness or smoothness, etc., and from their breaking apart readily into chains appearing much as the æcidisopores. Believing thus that the peridial cells are developed from the æcidisopores what would seem more natural than that we should examine and describe them as we do the æcidiospores.

In the examination of Uredineæ I have noticed that while the peridial cells are usually very similar in shape and size (yet no more so than the æcidiospores), they are frequently quite characteristic.

In *Æcidium pentstemonis* for instance, the peridial cells are angular, subrotund-elliptical, thick walled, smooth, 19–22 by 22–31 μ., while in the Æcidium *Puccinia tanaceti* D.C., on *Artemisia cana* and *A. canadensis* they are subrotund-angular, 15–21 by 19–26 μ., being very similar to the last, but distinguished by size, being in general smaller. In *Æcidium compositarum* Mart. var. *lygodesmiæ* Webber, they are angular-elliptical and usually strongly tuberculate, distinguished from the pre-

[1] Edited by Prof. C. E. Bessey, Lincoln, Neb.

ceding by shape and character of the surface. In *Æcidium euphorbiæ* Gmel. they are similar to those of the preceding species, but the cells are shorter (15–20 by 19–25 μ.), and not so strongly tuberculate. In many species characteristic differences may be be found. Why not describe them?—HERBERT J. WEBBER, *Lincoln, Neb.*

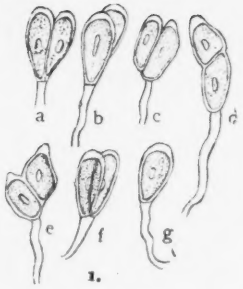
Peculiar Uredineæ.—An abnormal fruit or seed, as a double apple or walnut, is always noted with curiosity by the most untrained observer; so are also such stable but uncommon developments as the navel-orange. Among lower plants the microscopic spores frequently present peculiarities as curious as these, yet although examined usually by careful observers only, they are seldom noted with anything more than usual interest.

In working over Nebraska Uredineæ I have observed a few curious variations from the usual forms that I think deserve particular mention.

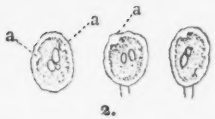
Puccinia flaccida B. & Br. (Pl. VIII., Fig. 1, Teleutospores; Fig. 2, Uredospores), a very peculiar species, presents the greatest and most uniform or stable peculiarity from the normal Puccinia, if I may so express it, of any species that it has been my fortune to examine. My specimens were collected at Lincoln, Nebraska, Oct. 13, 1889, on Barnyard-grass (*Panicum crus-galli*). The sori are amphigenous, linear-oblong, small and rather inconspicuous. The teleutospores are frequently one-celled (Fig. 1, *g.*), and in this case are of nearly the same size as the two-celled spores. The septi of two celled spores are in various positions, from almost horizontal to vertical. I have never found onewith a strictly horizontal septum. They are quite frequently almost vertical, each cell attached in part to the pedicel (Fig. 1 *a.* and *f*). In this case they appear as double Uromyces spores. In fact the species seems to me to more resemble a Uromyces than a Puccinia, the one-celled spores, which are always plentiful, being the normal form, and the two-celled spores, with the nearly vertical septi, double spores. About as near an approach to the normal Puccinia as usually occurs is represented by Fig. 1, *d*, and even here the partition is quite oblique.

Burrill, in "Parasitic Fungi of Illinois, Uredineæ," p. 202, says of this: "A most peculiar species. From two-thirds to three-fourths or more of all the teleutospores are septate, presenting the most varying and aberrant forms. So far as we are informed this has not been previously reported from America, but a comparison with specimens kindly furnished by Dr. M. C. Cook of *Puccinia flaccida* B. & Br. from Ceylon, leaves no doubt of the specific identity. The American specimens only differ in possessing more undivided and, upon an average, narrower teleutospores, with somewhat thicker pedicels."

PLATE VII.



1.



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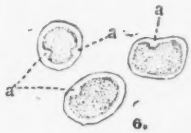

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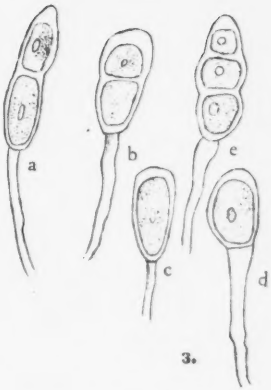

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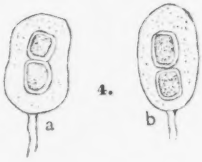

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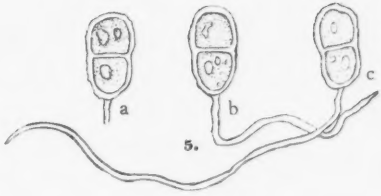

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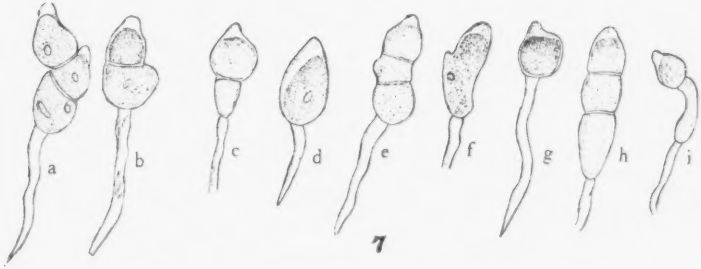
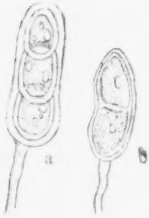
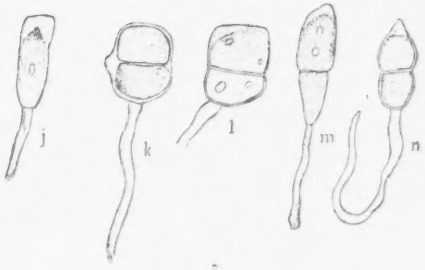


7



8.



9

The uredospores of this species also illustrate an interesting feature, sometimes occurring among Uredineæ,—the so-called "*germ pores*" (Fig. 2, *a*), two or more hyaline points in the wall of the spore. The spore thus greatly resembles a pollen grain, the points being very likely analogous to the similar thickenings on the pollen grain, furnishing a spot for the breaking through of the tube in germination.

This peculiar feature is found also in the uredospores of *Puccinia prenanthis* (Pers.) Fuckel (Fig. 6, *a*, from specimens collected at Anselmo, Nebraska, July 8, '89). The æcidium of this species is also peculiar, from its lack of genuine pseudoperidium. In the place of the usual pseudoperidium a pseudoparenchymatous hyphæ mass occurs. This is probably the *Æcidium hemisphericum* Pk.

In *Puccina sporoboli* Arthur, (Fig. 3) I find one-, two- and three-celled teleutospores. This species is peculiar in that some of the sori bear only one celled teleutospores (Fig. 3, *c*, and *d*), while others bear only the normal two-celled teleutospores (Fig. 3., *a* and *b*), and still others produce a sometimes almost equal mixture of one- and two-celled teleutospores, with frequently also three-celled ones (Fig. 3, *e* represents a three-celled teleutospore measuring 26.6 by 14.4 μ.) This peculiarity of one- and two-celled spore-sori I find only on specimens growing on *Sporobolus vaginæflorus*, collected at Lincoln, Nebraska, October 13, 1889. Other specimens of the same species on *Sporobolus asper* and *Sporobolus cryptandrus* have only the two-celled teleutospores. Dr. Arthur in the original description from specimens on *Sporobolus heterolepis* mentions the same peculiarity.

Puccinia tanaceti D. C., var. *actinellæ* Webber, on *Actinella acaulis* furnishes in the same sorus a remarkable variety of teleutospores, the contortions being almost as various as those of *Puccinia flaccida*, though not so frequent. Fig. 7, *an*, shows some of the various forms of the teleutospores; (*a*) is a three-celled spore with two apical apices, the upper cell seems as if grown from the side of the middle cell; (*b*) is almost normal, with basal cell large; (*c*) with large apical cell; (*d*) one-celled; (*e*) three-celled, 21 by 50 μ.; (*f*) one-celled, with side point, 19 by 45 μ.; (*g*) one-celled, 26 by 28 μ.; (*h*) three-celled, 19 by 76 μ.; (*i*) curved, lower cell abortive; (*j*) one-celled, 19 by 53 μ.; (*k*) large, truncate, with side point, 38 by 45 μ.; (*l*) large truncate, 30 by 42 μ.; (*m*) normal spore, 19 by 70 μ.; (*n*) normal spore, 22 by 49 μ.

The teleutospores of the genus *Uropyxis* are exceedingly interesting and important as being one of the main proofs from spore resemblance that the Uredineæ are degraded Ascomycetes, the teleutospore

stage being the homologue of the spore fruit, the teleutospore of the ascus and the teleutospore cells of the ascospores. The clear outer pellicle here greatly increases the resemblance to the ascus. A few weeks ago while examining *Uropyxis petalostemonis* (Farl.) D. By., a three-celled teleutospore was observed (Fig. 8, *a*). The resemblance of the normal form to the ascus is plain, but here it was indeed striking, the walls of the cells were so plainly distinct from the pellicle and that of one cell from the other cells. The spores could plainly be seen to overlap as they lay surrounded by the clear pellicle, the spore sac or ascus.

In many teleutospores, if not in all, an outer surrounding sac entirely separate from the enclosed spores may be differentiated. It may readily be seen by heating the spores for a few moments before mounting in nitric acid. In spores thus treated the wall swells out, leaving the spores within clearly distinct. Brownian movement may frequently be seen between the separated wall and the spores, indicating that it is not merely a swelling of the wall, but a separating, the space created being filled with a fluid. A teleutospore of *Puccinia jonesii* Pk. treated in the above manner is represented by Fig. 4, *a*. Three of the normal spores are shown in Fig. 5. Another peculiar feature of this species is its long and exceedingly fragile pedicels (Fig. 5, *b* and *c*). They were described by Peck originally as exceedingly short (Fig. 5, *a*), the mistake being caused undoubtedly by their easy deciduous character. In type specimens, it was only by long soaking and repeated attempts that I obtained the pedicels attached (See Ellis, N. A. F., No. 1448). In Nebraska, specimens on *Musenium tenuifolium* while fresh, I with but little difficulty, found them attached.

Spores of *Puccinia nigrescens* Pk., a typical Puccinia, treated in nitric acid, presented the same peculiar swollen appearance (Fig. 4, *b*).

Typical Puccinia spores prepared as above greatly resemble spores of Uropyxis. Schröeter, in Hedwigia, 1875, p. 65, separated *Puccinia amorphæ* Curt. from Puccinia, placing it from the distinct outer hyaline layer of its spores in a new genus, which he called Uropyxis. To this genus one more species, *Uropyxis petalostemonis* (Farl.) De Toni, has since been added. Some mycologists think the difference between the two genera too slight to justify distinction. The difference at most is but slight, and when we treat Puccinia spores with nitric acid as above the distinction vanishes entirely. Are we then to consider Uropyxis as distinct from Puccinia merely because the spore is surrounded by an outer *distinct* layer, while in Puccinia the outer layer occurs but is indistinct?—HERBERT J. WEBBER, *Lincoln, Neb.*

Grasses of Box Butte and Cheyenne Counties, Nebraska. —On August 21st, 1889, I started out from Alliance, Neb., on a short trip of observation to determine particularly the grass flora of southern Box Butte and northern Cheyenne counties.

Alliance is about four miles east of the 103d meridian west of Greenwich, directly on the line of the 42d parallel. The town lies on a broad level plain, which appears to have been at one time the bed of a lake. Southward and eastward, from eight to ten miles distant, are the sand hills. To the west is the broad valley of Snake Creek, a creek which, like nearly all of the streams of this region, flows from the sand, rushes rapidly forward a few miles, and disappears, losing itself in the sand. North and northwestward the land rises toward Pine Ridge. The only apparent outlet of this lake basin is toward the east, in a pass through the sand hills.

On this level plain, parched and barren under the August sun, the principal grasses found were Gramma, *Bouteloua oligostachya* Torr., and its near relative *Bouteloua hirsuta* Lag., Buffalo-grass, *Buchloë dactyloides* Engelm., wild wheat grass, *Agropyrum glaucum* R. & S., and two others, very common, but of no agricultural value, a Beard-grass, *Stipa* sp.—near *comata* Trin., and prairie wire-grass, *Schedonnardus texanus* Steudel. The great bulk of the prairie grass was Gramma, and I was told that it is *the* pasture grass of the region.

On the morning of the day named, I went in company with Mr. Nelson Fletcher, of Alliance, to a natural meadow of about 350 acres, lying in the Snake Creek valley, just at the foot of the sand-hills southeast of the town. The ground was wet but not swampy, and the rank plant growth which covered it formed a pleasing contrast to the sweltering sandy slopes around the meadow. The chief grass was *Agropyrum glaucum*, which differed from the form found around Lincoln in having longer and less harsh leaves. Mixed with it were *Andropogon scoparius* Michx., *A. provincialas* L., *Muhlenbergia glomerata* Trin. *Elymus canadensis* L., and *Panicum virgatum* L.

With these grasses were tall golden rods, purple blazing stars, and white-flowered asters, altogether making a brilliant flowery oasis in a sandy desert. The growth was very even, from 2½ to 4 feet high. Mr. Fletcher said that although no hay is cut on the open prairies enough is obtained from these natural meadows, and it is hay of very good quality, so that the average price ranges from two to four dollars per ton.

About a mile east of this meadow stood what appeared to be a large field of corn, but on nearer approach it proved to be Reed grass *Phrag-*

mites communis Trin. This grass and cat-tail flags and rushes were quite common in the swampy meadows and around the numerous small lakes of the sand-hill region.

Along the valley of Snake Creek I found in addition to those already mentioned *Andropogon nutans* L., *Oryzopsis cuspidata* Beuth., *Sporobolus airoides* Torr., *S. vaginæflorus* Vasey, *S. asperifolius* N. & M., *S. asper* Kth., *Panicum capillare* L., *Setaria glauca* Beauv., *S. viridis* Beauv., *Deyeuxia canadensis* Beauv., *Distichlis maritima* Raf., and *Spartina cynosuroides* Willd.

In the sand-hills around Alliance the principal grasses are *Andropogon hallii* Hack., *A. provincialis* Lam., *A. nutans* L., *A. scoparius* Michx., *Sporobolus asper* Kunth, *Oryzopsis cuspidata* Bedth., *Bouteloua oligostachya* Torr., *Deyeuxia canadensis* Beauv., *Eragrostis tenuis* Gray, *Stipa comata* Trin., and on the higher hills, and particularly noticeable on the edge of the "blow-outs," *Muhlenbergia pungens* Thurb. In the clear white sand in the "blow-outs" *Redfieldia flexuosa* Vasey is found quite abundantly.

The best grazing grasses are Gramma and Buffalo-grass. Wild wheat grass is good for hay but not for pasture.

I did not find any Sand-burs. They are not needed, for Mammillaria and other cacti make life a burden.

From Alliance I went west along Snake Creek valley twelve or fifteen miles, then southwest through the extreme western extension of the sand-hills till I struck the old Black Hills trail at the head of Red Willow cañon, and thence down the Red Willow southeastward to the Platte. The only new find was *Munroa squarrosa* Torr., on the Platte side of the divide.

From the Camp Clarke, on the Platte, where the old Sidney-Black Hills trail crosses the river, I went south to Court House Rock and Pumpkin Creek. The rock is a great mass of light brown argillaceous sandstone, which rises about 300 feet sheer above the valley.

The ridge stretching westward, of which Court House Rock was once a part, at one time bore a forest of pine and cedar. Now there are only some stumps and a few scattered trees to show what has been before. In the cañons at the foot of Court House were *Rhus aromatica* Ait. var. *trilobata* Gr., and a number of woody shrubs and vines.

On the summit of the rock I found *Oryzopsis suspidata* Benth., *Agropyrum glaucum* R. & S., *Aristida purpurea* Nutt., a form with an erect culm rising from a mat of convolute wiry radical leaves, *Bouteloua racemosa* Lag., the first that I had seen, *B. oligostachya* Torr., and *Muhlenbergia pungens* Thurb.

By the side of the creek, at the base of the rock, I found *Eatonia obtusata* Gray, *Elymus canadensis* L., *Panicum virgatum* L., *P. crus-galli* G., and *P. crus-galli* var. *hispidum* Gr., *Aristida purpurea* Nutt., *Bouteloua oligostachya* Torr., *Munroa squarrosa* Torr., *Oryzopsis cuspidata* Benth., *Sporobolus airoides* Torr., and *Cenchrus tribuloides* L.

The Sand-burs have probably been introduced in the Pumpkin creek valley in the wool of sheep which have been herded there.

NOTES.—I did not find *Munroa* north of the Platte river valley. *Andropogon hallii* grew on the foot hills between Camp Clarke and the Court House ridge. These hills are sandy but are not true "sand hills," as that name is applied in the West.

Distichlis maritima is the chief pasture grass of the Platte valley in this vicinity! Other grasses, *Buchloë*, *Bouteloua oligostachya*, *Spartina cynosuroides*, *Agropyrum glaucum*, *Hordeum jubatum*, *Setaria glauca*, *S. viridis*, *Munroa squamosa*, and *Panicum crus-galli* also occur, but by no means as abundantly as the Distichlis.

I visited from fifteen to twenty of the islands in the river at this point. I found two grasses other than the common Platte valley species. They were *Glyceria distans* Wahl., and *Sporobolus depauperatus* Torr. The characteristic plant of these islands is *Shepherdia argentea*, a small shrubby tree known as the Buffalo-berry.—JARED G. SMITH, *Lincoln, Neb.*

ZOOLOGY.

The U. S. Fish Commission.—Anthozoa and Echinodermata of the Gulf Stream Slope of the New England Coast.—At various times during 1882, Prof. A. E. Verrill has given to the world notice of the remarkable marine fauna, to a great extent tropical in character, occupying the outer slope of the continental plateau off the southern coast of New England. The abundance of animal life on these banks may be judged from the fact that at a single haul, made on September 1, 1881, over ten thousand specimens were procured. In Prof. Verrill's words "a large number of species, belonging to various zoological groups, in this region are found living gregariously, in vast numbers, at particular spots, while they may not occur at all, or only sparingly, at other stations in similar depths, and apparently identical in temperature and character of bottom."

Among the discoveries of new and rare species during 1881, are the following Anthozoa: *Urticina longicornis*, *U. perdix*, *U. callosa*,

U. consors, *Actinurus saginatus*, *Adamsia sociabilis*, all new species; *Pennatula aculea*, Dan. and Kov.; *P. borealis* Sars.; *Balticina finmarchica*, Sars.; *Anthroptilum grandiflorum*, Verrill; *Bathyactis symmetrica* Moseley; *Sagartia abyssicola* Verrill. In all thirty-three species, including seven *Pennatulaceæ*. *Adamsia sociabilis* always starts life upon a small shell, usually a *Cavolina*, occupied by a hermit-crab (*Hemipagurus socialis*, Smith), but eventually secretes a chitinous pellicle and absorbs the shell. *Flabellum goodei*, a very fragile coral which is tolerably common, has the power of restoring itself from mere fragments, and the same has been noted in *Parasmilia lymani* Pourtalis. The present year has yielded a remarkable new pennatulid (*Distichoptilum gracile*, Verrill), and two Gorgonians; *Acanthogorgia armata* V., dredged at 640 fathoms, and *Paramauricea borealis* V., from 234 fathoms; the former, when living, was bright orange, the latter pale salmon.

Pennatula borealis, previously known only from a few Norwegian specimens, has been taken both by Gloucester fishermen and the U. S. Fish Commission, at depths varying from 120 to 350 fathoms. The largest one was 21½ inches high nnd 5¼ broad. Some of the Actinians are very large,—*Urticina callosa* is four to seven inches high, and six to ten wide. Occasionally a barrel of large Urticinæ or of *Bolocera tuediæ* Gosse has been brought up at a single haul.

Acanella normanii V., a pretty bush-like gorgonian, was very abundant at some stations, as were also *Pennatula aculeata*; *Flabellum goodei*, and, in one spot, the usually rare *Anthomastus grandiflorus* V. One of the most striking instances of commensalism was that of *Epizoanthus paguriphilus* V., upon the previously rare hermit-crab *Parapaguras pilosimanus* Smith. The polyp forms the habitation of the crab out of its own tissues, and neither polyp nor crab have hitherto been found living separate. *Bathyactis symmetrica* has a wider bathymetrical and geographical range than any other known species, as it has been found off Florida, off the Azores, in the South Atlantic, at depths of from 1900 to 2650 fathoms; in the South Indian Ocean, from 1600 to 1950 fathoms; in the Malay Archipelago and West Pacific, in from 360 to 2440 fathoms; east of Japan, in 2300 to 2400 fathoms; off Valparaiso, in 1375 fathoms; on the New England coast, 225-252 fathoms.

The species of Echinodermata dredged in 1881 were in all forty-eight, twenty-two of which had not previously been found upon our coast; twenty-six may be considered as arctic, twenty-two are European, and fourteen or more have been taken off Florida or in the Gulf of Mexico.

Among these forms were *Dorocidaris papillata* (this was previously not supposed to occur north of the Gulf stream, off the coast of Florida); *Schizaster canaliferus* L. Ag., somewhat different from the type, probably a geographical variety, *Brissopsis lyrifera* Ag.; *Phormosoma sigsbei* A. Ag., *Archaster bairdii* sp. nov., in general appearance like *A. parelli* and *A. agasszii*; *Ophioglypha aurantiaca* sp. nov; *O. confragosa* Lyman, the type specimens of which were dredged by the Challenger off the La Plata in 600 fathoms; *Amphiura macilenta* sp. nov., very abundant off Martha's Vineyard; *Toxodora ferruginea*, a new genus and species of holothurian; *Asteras briareus* sp. nov., *Ophioglyphia sarsii* Lütken, which occurs in two varieties, one abundant in shallow water, the other, with less prominent disk-scales, common in the depths of the Bay of Fundy and off Nova Scotia; *O. signata*, sp. nov., not rare in deep water; and *Antedon dentatum*, first described by Say from Great Egg Harbor, N. J., as *Alectro dentata*.

At one spot two or three barrels of *Ophoglypha sarsii* came up at one haul; and *Archiaster agassizii* occurred in great numbers in one spot, at 337 fathoms.

The work of 1882 has obtained nearly all the species found in 1881, with the addition of the following: *Solaster earllii*, Verrill, a Diadema-like sea-urchin with nine arms, and of a bright scarlet color; *Lophaster furcifer; Astrogonium granulare, Astrophyton lamarckii*, also bright orange; *Asteronyx loveni* M and Tr., found upon a pennatulid at 700 fathoms; a new Ophioscolex, and *Rhizocrinus lofotensis*.

That the arms of an Ophiuran can be restored after they have been broken, or entirely lost, is well-known; but Prof. Verrill has seen cases in which the entire dorsal disk, with the contained viscera, had been lost and more or less restored. The species exhibiting this strange power was *Amphiura abdita* V., and the specimens were taken among *Zostera* at Noank, Conn. The dorsal disk is soft and swollen, and easily torn away, leaving only the jaws connecting the arms. In some the new disk, though perfect in form, had not reached more than one-third or one-half the diameter of the old one. Prof. Verrill thinks it probable that his *A. macilenta* is the true young of this species.

The headquarters of the U. S. Fish Commission, during both 1881 and 1882, were at Wood's Holl, Mass. During 1882 only five trips were taken to the Gulf Stream slope, but these were successful ones. The total number of Invertebrata now on the lists of the fauna of this belt is about 575, and this neither includes the Foraminifera nor the Entomostraca, which are numerous, and but few of the sponges. Of those determined, about 265 are Mollusca, including 14 Cephalopods;

85 are Crustacea; 60 Echinodermata, and 65 Annelids. About 75 species of fishes have also been found here. Many species, especially Crustacea, common in the two previous years, were scarce or absent in 1882. This, as well as the great destruction of the tile-fish (Lopholatilus) was, in Prof. Verrill's opinion, probably caused by a very severe storm that occurred in this region, which "by agitating the bottom water, forced outward the very cold water that, even in summer, occupies the great area of shallower sea, in less than 60 fathoms, along the coast, and thus caused a sudden lowering of the temperature along this narrow *warm zone* where the tile-fish and the crustacea referred to were formerly found."—W. N. L.

The Ectoderm of Spongilla.—According to one group of authorities the ectoderm of the larval sponge is transformed directly into that of the adult, while others claim that during metamorphosis the ectodermal larva entirely disappears. To ascertain the real facts in the case, Otto Maas contrived apparatus whereby a single embryo of spongilla could be kept constantly under observation during all its stages until sometime after attachment, and he concludes (*Zool. Anz.*, No. 316) that the larval ectoderm is transformed directly into that of the adult. At first the cells are columnar; after becoming attached the animals increase rapidly in size, which is accompanied by a flattening of the ectoderm, which is now cubical and growing flatter and flatter; the cell boundaries disappear, but always a sharp focusing will reveal a double contour. The ectodermal tissue is visible and the layer appears as an extremely thin hyaline membrane. Götte's sections in which no ectoderm was visible are interpreted as artificial products, the delicate ectodermal pellicle having been torn away in spots in the processes of preparation.

Copulatory Marks in Spiders.—There are very few instances in the animal kingdom of easily recognized marks of copulation. The cases of spermatophores protruding from the female genitalia, the male copulatory organs adhering in the female of the honey bee, and occasional male palpus sticking in the epigyne of spiders, and the hardened secretion forming a sort of pocket on the abdomens of certain butterflies (Parnassia, etc.), are all noticeable from their peculiarity. Dr. Bertkau finds that in spiders of the genus Argenna a similar sign occurs. Immediately after copulation the opening to the spermathecæ becomes covered with a little white or slightly rosy lid, which may be retained for a considerable time, even months. The

origin of the secretion which produces these lids is utterly unknown, nor is it known whether it is produced by male or female.

New Glands in the Hemipterous Embryo.—It is well known that in the insect embryo traces of rudimentary appendages occur on the abdominal segments, but the histology goes to show that these evanescent structures on the first abdominal segment have lost their ambulatory function and have taken on another. One series of investigators believe that they are gills, the other as sense organs or glands. Mr. W. M. Wheeler has studied homologous structures in Cicada and Nepa, and finds (*Zool. Anz.*, 317) that in these forms there is no protruding appendage, but in its place a swollen ectodermal patch composed of greatly elongate epithelial cells, flat on the free surface and extending itself into the interior of the body. Proceeding from these cells was found a secretion which varied in character (in hardened specimens) in the two forms studied. In Cicada it formed a vacuolated transparent mass; in Nepa it formed a brush-like mass of elongate threads, apparently a thread to each secreting cell. There was apparently no connection with the nervous system, so that these organs in the Hemiptera must be regarded as glandular. Concerning the functions of these and other similar glands, it is difficult to say, but it is possible that they may fall among the category of silk-glands, and play a part in making these forms nauseous mouthfuls for insectivorous animals.

Abdominal Appendages of Lepismida.—Oudeman shows that there is a regular succession in the appearance of the ventral abdominal appendages in the Thysanurous form, *Thermophila furnorum*. In the smallest forms only the pair belonging to the ninth segment are present; increase in size brings the eighth pair, while only the full grown individuals have appendages on seventh, eighth, and ninth segments. Oudeman thinks this adverse to the view that these are rudimentary appendages homodynamous with the others.

The Segmentation of the Vertebrate Brain.—Mr. C. F. W. McClure attacks (*Zool. Anz.* 314) this oft-studied problem from another standpoint. He finds, in studying Amblystoma, Anolis, and the chick, that there is an evident segmentation of the nervous centre, it being divided, in an early stage, into segments or neuromeres, which alternate with the mesodermic somites. This segmentation extends into the cranial region, and embraces the whole of the brain, the forebrain consisting of two (possibly a portion of a third), the mid-brain

of two or three, and the hind-brain of six or five neuromeres, a total of ten, which correspond with the line of division between the nine mesodermal somites recognized by Van Wijhe in the head.

The Origin of the Pelvis.—Wiedersheim, in a preliminary account of the origin of the vertebrate pelvis (*Bericht d. Naturf. Gesellschaft*, February, IV., 1889), claims that the key to the first appearance of this structure is to be found in *Lepidosiren annectens*. Here the fibrous tissue of two pairs of myotomes in front of the cloaca through a process of chondrification reach a higher condition of connective tissue. These cartilaginous zones fuse in the *linea alba abdominis* to form an unpaired plate, thus affording a solid support for the free extremities. This process, which occurs again ontogenetically in the lowest urodele Batrachia, finds a parallel in the chondrification of a number of myotomes in the thoracic region of certain perennibranchiate Batrachia,—*i.e.*, in the rudiments of hyaline cartilage ventral ribs. The sternum of the Batrachia also falls in the same morphological category.

The vertebrate pelvis also owes its first appearance to the conversion into cartilage of a pair of abdominal myotomes—or to use the terms of human anatomy, of the *inscriptiones tendineæ* of the ventral body muscles.

The Stapedial Bones.—Dr. C. K. Hoffman claims (*Zool. Anz.*, 310) that the stapes in the reptiles arises from two sources. The otostapes arises from the outer layer of periotic mesoderm as a strong lateral process. At about the same time the hyoid arch is prolonged into a medial projection, the hyostapes, which unites with the otostapes to form the stapes, while the connection with the hyoid is lost. Hoffman thinks that similar relations can be traced in the Mammalia. The stapes proper is the otostapes, and the os lenticulare is the hyostapes. The fact that the facial nerve innervates the stapedial muscle on the lenticular portion lends probability to this view.

Frogs Eating Snakes.—(January NATURALIST, p. 74). If Mr. H. L. Roberts will turn to page 348 of my "Naturalist's Rambles About Home," he will find that I have described in full an instance of a frog (*Rana pipiens*) swallowing a snake. More recent observations have convinced me that such an occurrence is not as uncommon as might be supposed, considering the fear usually exhibited by a frog when a snake approaches.—CHARLES C. ABBOTT, *Trenton, N. J.*

Voice of Hyla andersonii.—The specimen of this beautiful batrachian referred to by Dr. Peters in the January NATURALIST is still in excellent health, and occasionally utters its characteristic cry, which should not be described by the word "peep," for this suggests a similarity to the cry of the Pickering's Hyla, which shrilly "peeps." The *andersonii* utters a single note, better described by the syllable "keck," which it usually repeats three or four times. It is not a frog-like note at all, but much resembles the call of the Virginia rail (*Rallus virginianus*). If the collector follows up any "peeper" in the marshes, he will not discover additional specimens of *Hyla andersonii*.—CHARLES C. ABBOTT.

The Trochlearis Nerve in Lizards.—Contrary to his earlier view, Hoffman now finds (*Zoöl. Anz.*, No. 310) that the trochlearis of the lizard at an early stage possesses a ganglion, and that it in all respects resembles one of the truly segmental nerves. This ganglion aborts at about the time of the deposition of the retinal pigment. He asks the question if this is not to be regarded as the first segmental nerve of the hind brain? In snakes, birds, and teleosts he finds no ganglion at any stage of development. He also suggests that the present distribution of the trochlearis may be secondary, and that formerly it was connected possibly with the occluding organs of the parietal eye.

Bats in the Wyandotte Cave, Indiana.—In the summer thousands and tens of thousands of bats assemble in Wyandotte cave, in Crawford county, and in other caves. A man living near Wyandotte cave, who had observed them for years, said that frequently in the early dusk of evening, he had seen a column of these flying animals from thirty to sixty feet in width and from two to three miles in length move from the mouth of the cave in a straight line going in a northwesterly direction. In a short time another column would move toward another point of the compass, and then perhaps another, each as long as the first, and, as long as within his observation, without straggling, and guided as by some reason or instinct that led these small-brained creatures to a known haunt or point. In the morning they would return, not in solid column, as they departed, but in large flocks or droves, passing into the cave, where they would be seen no more until the next evening. "Faneuil Hall" is a spacious corridor in Wyandotte cave, forty feet wide and eighteen to twenty feet high. Here daylight ends and darkness begins. Here we see the first of cave life. Here are clusters of bats which sleep in the daytime, hanging by their

hind feet with their heads downward. They hibernate in myriads in the winter, attached to the sides and roof by their hind feet. The surface of the stone being porous affords great attachment to their claws, while the peculiar construction of their feet makes the grasp of their claws stronger the more and the longer the weight is attached to them. They collect in clusters, so that they are in contact with one another, and the animal heat thus retained assists in their comfort. The cave temperature ranges from 58° in the fall down to 52° or 53° in the spring, and the cave "breathes" semi-annually at the autumnal and vernal equinoxes, having a discharge of warm air in the fall, and an inflow of cool air during the winter. In the cooler weather the bats are not satisfied with a single layer, but are attached like swarms of bees, hanging down. The highest temperature in the highest part of the cave is 66° in the winter. This cave is floored in two stories. Passing on one goes through numerous halls, corridors, arches, and domes, which are occupied to a greater or less extent by these Chiroptera. For reasons known to themselves alone some of the rooms are favored spots, while others are rarely occupied by them.

The southern route in the cave was discovered in 1850, and was unvisited up to that time by quadrupeds like raccoons and opossums, because the opening was too small for them to pass through. The current of air passing in was very slight, and the temperature uniform. This made it a favorite place for these furry flyers. The second hall, "Bats' Lodge," as it is named, is a spacious room in which the bats delight to assemble for council purposes, it would appear, as well as sleep. I saw the ceiling largely covered with clusters of them crowded closely together. Disturbed by our entrance, the room was filled with their slight, plaintive, whining, whispering voices and the disagreeable odor of their bodies. My first visit was in the early autumn. The results noted were taken in December, when the outer world was cold enough to close the Ohio river with ice, and the thermometer at the mouth of the cave was from six to twelve degrees below zero. The bats were evidently hibernating, and, although somewhat torpid, yet, when disturbed, in falling they dropped a distance of six or eight feet, their bodies rarely fell to the ground. Recovering the use of their wings, they would fly back to one of the clusters. There are two kinds of bats in Indiana—the red bat and the common black bat. The red bat is the Southern type, and is rare, only occasional specimens having been taken.—JOHN COLLETT, in *Indianapolis Journal.*

Zoological News.—General.—Volume XXX., part I, of the *Quarterly Journal of Microscopical Science* contains an index extending from 1853 to 1888; an Index to the Transactions of the same society from 1844 to 1852; and to the Proceedings of the Dublin Microscopical Society from 1865 to 1880.

Sponges.—Von Lindenfeld thinks that the collared endoderm cells of the sponges are never free, but are imbedded in a ground substance from which they are capable of some protrusion. He also thinks that the "membrane" recently described by Dendy and Sollas in certain sponges is, in reality, but the free surface of this ground substance.

Worms.—*Otoplana intemedia* is a new turbellarian described by Dr. du Plessis as combining many features. It has no eyes, but has an otocyst in front of the brain, ciliated pits on either side of the otocyst like those of the nemertines, long, symmetrically placed tactile hairs on each side of the body; the surface of the body is covered with sticky cells (Klebzellen); there is a single median posterior sexual opening; and the alimentary canal is dendrocœlous.

Mollusca.—Pelseneer (*Zoöl. Anz.*, 309) denies that the hooks of the pteropod molluscs have any morphological value, a view at variance with that expressed by Schalfejeff.

The thirtieth volume of the Challenger series concludes with a supplementary report upon the Polyzoa, and is by Mr. A. W. Waters. It consists of 41 pages and 3 plates.

Fishes.—Prof. A. C. Haddon writes to *Nature* (Jan. 17, '89) that apparently the tail in Periophthalmus is an efficient organ of respiration. He also describes the methods of fishing for turtles with the suckfish or remora, employed by the natives on the shores of Lowes Straits.

The American genus Carpiodes (Catostomidæ) has been found in Australia.

Reptiles.—Dr. G. Baur, in his Osteological Notes on Reptiles (*Zoöl. Anz.*, No. 296), calls attention to the fact that in *Podocnemis dumeriliana* the neck vertebræ possess the same saddle-shaped articulation of the centra which hitherto has not been found outside the group of birds. Baur also characterizes anew from osteological details the Trionychidæ, Sternothæridæ, Podocnemidæ, as well as adding some notes on other families. He maintains, contrary to Boulenger, the distinctness of Erymnochelys from Podocnemis.

Arthropoda.—Mr. F. A. A. Skuse recently described before the Linnæan Society of New South Wales a new genus (Batrachomyia) and two new species of flies closely allied to Oscinis, which are peculiar in laying their eggs beneath the skin of frogs.

A comparative study of the alimentary canal of the larvæ and imagines of the Ephemeridæ is interesting, since these forms take no nourishment in the adult condition. Fritze (Bericht Naturf. Gesellsch. Freiburg, IV.) has made such a study, carefully detailing the histology of several species in all stages. His results in brief are that at no time is the alimentary canal rudimentary, but that at the time of metamorphosis it becomes emptied of food, and is then distended with water, so that the columnar epithelium of the mesenteron is stretched into pavement epithelium. Later the water is replaced with air, which is serviceable in lessening the specific gravity of the perfect insects.

Birds.—A short note in the March *Geologist*, by W. K. Parker, tends to somewhat rehabilitate the old and still popular idea that swifts and swallows are related. Though Mr. Parker places the former among the Picariæ, he says that they are on the passerine verge of the group, and have an ægithognathous palate, *i. e.*, the vomer is fused with the floor of the nasal labyrinth. The proportions of the wing in the group vary greatly, as may be seen from the following measurements of its members in two of the largest Cypselidæ:

	Humerus.	Ulna.	Manus.
Macropteryx mystacea,	24 mm.	29 mm.	47 mm.
Chætura caudaca,	17 "	24 "	57 "

Swifts and humming-birds, like passerines, have no second phalanx on the "pollex," nor a third on the index.

Aphriza virgata affords Dr. Shufeldt material for an essay regarding the osteology and taxonomy of the snipe, plovers, oyster-catchers, and surf-birds (*Jour. Morph.* II., Part 2). He concludes that the existing classifications do not properly represent the relations of the Limicoline birds, and that the Aphriza and Arenaria should each be raised to family rank.

Mammals.—Mr. Robert Gray (*Zoölogist*, March) relates the discovery of a herd of narwhals asleep, with the spiracles under water in many cases; and states his conviction, which is that of many intelligent whalemen, that the Cetacea habitually sleep under water, and either wake to breathe, or do so by reflex motions. Whales have been

seen to emerge from under fields of ice without air-holes, and they disappear from the surface with some regularity. It is only when the water is smooth that Cetaceans have been found asleep on the surface.

J. E. Harting (*Zoölogist*, March, 1889) states that the roebuck is still found wild in Dorsetshire, and that there are a few near Wigton, in Cumberland; otherwise, it is now almost entirely confined to Scotland. Even in Dorset its presence is due to a reintroduction. A curious fact in the life history of the roe is that, though the rutting season is in August, the ovum lies dormant until December, when it developes at the normal rate. Occasionally a female roe has horns.

The discovery in the Hebrides of *Mus hibernicus*, a species which, like *Mus decumanus*, has the tail shorter than the head and body, and the ears relatively small, forms the subject of the first article in the *Zoölogist* for June, 1889. It is a smaller and more elegant animal than *M. decumanus*, with finer fur, of a dark silvery gray, almost black tint, upon the back. The far of the sides is paler, and the under surface is silvery mouse-gray.

In the September issue of the same periodical Mr. T. Southwell states his belief that *M. hibernicus* is a hybrid.

Alphonse Milne Edwards has recently described a peculiar marsupial from New Guinea, under the name *Dactylopsila palpator*, remarkable for the enormous length of the fourth digit of the hand, which nearly equals the elongate third digit of the Malagassy Aye-Aye.

PHYSIOLOGY.[1]

Nature of Knee-jerk.—There are two theories of the nature of the knee-jerk phenomenon: one regards the process as entirely peripheral, the muscle fibres being directly stimulated to contraction by the twitch of the tendon; the other regards the action as reflex. Objections to both exist; to the peripheral theory, especially the fact that the reflex arc must be functional; to the reflex theory, the fact that the time necessary is very short—only about one-fourth that of other reflex actions. Dr. Lombard, who made an elaborate study of the phenomenon in 1887,[2] brings forward the results of experiments to prove the tenability of the reflex theory.[3] These experiments were made on

[1] This department is edited by Dr. Frederic S. Lee, Bryn Mawr College, Bryn Mawr, Penna.

[2] See *American Journal of Psychology*, Vol. I.

[3] *Journal of Physiology*, Vol. X, p. 122.

twenty-five students, in whom the knee-jerks resulting from the blows of a hammer, the force being known and constant, were recorded on a drum. The peripheral theory assumes that the tension of the muscle determines its ability to respond to mechanical stimuli, and that this tension depends on tonus impulses originating in the spinal cord. These assumptions are without proofs, and the theory is opposed by facts. "The knee-jerk may be present when muscle tonus appears to be wanting, and may be absent in the case of men who apparently have a normal amount of tonus. When the knee-jerk is lacking, it cannot be restored by any amount of tension which can be artificially supplied to the muscle. The tonus theory does not explain the difference which always exists in the size of the successive knee-jerks, for it is found experimentally that the size of the knee-jerk is not influenced by slight variations in the tension of the muscle; nor can the changes in the amount of the knee-jerk be attributed to alterations of the irritability of the muscle dependent on fine variations in tonus, because experiments show that the irritability of the muscle does not change within short intervals of time. The peripheral theory does not explain the reenforcements of the knee-jerk [*i.e.*, the increase of the latter when it is accompanied by voluntary motion in some part of the body or by sensations], because reenforcing acts, unless very violent, do not alter the tension or irritability of the muscles. The discovery of Mitchell and Lewis, that muscular contraction called out by electrical stimulation cannot be reenforced, is inexplicable by the peripheral theory, though readily explained by the reflex theory. Finally, occasionally the flexors, as well as the extensors, of the knee are seen to contract in response to the blow on the ligamentum patellae. This contraction of the flexor muscles is of reflex origin, and there is little reason to doubt that the extensors are irritated by the same reflex process. The idea that the flexors are mechanically stimulated by the strain brought on them by the sudden extension of the knee is untenable, because we know that muscles are not irritated by slight strains on their tendons, and the flexors are seen to contract when the knee has extended so little as to bring almost no strain upon them; moreover, in spite of the fact that the muscle irritability does not change within short intervals of time, small knee-jerks may be seen to be accompanied by marked contractions of the flexors, and, immediately after, large knee-jerks by little or no flexor contraction."

——Pick[1] finds histological evidence in favor of the reflex theory.

[1] Archiv f. Psychiatrie, XX., 3, p. 896; cf. Centralblatt f. Physiologie, 1889, No. 12, p. 272.

In a paralytic the left knee-jerk was wanting, and the right was present with motor reinforcement only. Post-mortem investigation of the spinal cord revealed marked degeneration of fibres in the region of the entering posterior roots of the lower dorsal and upper lumbar sections on the left side, less on the right side; the fibrous portion of Clark's columns was more atrophied on the left than the right, also the left posterior roots in places. This confirms Westphal's localization of the centre for the knee-jerk.

Heat-centres.—The localization and even the existence of heat-centres in the human central nervous system is still in dispute. According to Ott,[1] six such centres, injury to which is followed by increase of temperature, have been localized in the lower animals. These are the cruciate in the region of the fissure of Rolando, the Sylvian, at the junction of the supra and post-sylvian fissures, the caudate nucleus, the region about the corpora striata, a point near the median line between the corpora striata and the optic thalami, and the anterior inner end of the optic thalami. Ott has collected a number of clinical cases as evidence of similarly located heat centres in man. The high temperature usually following lesions of the spinal cord, medulla oblongata, or pons varolii, is explained as due to a removal of the influence of the thermotoxic centres allowing spinal thermogenesis to become exaggerated.

——At a recent meeting of the Neurological Society of London, when pyrexia was under discussion, Victor Horsly[6] gave some results of observations on the differences of temperature of the two sides of the body as symptomatic of cerebral lesions. He states that in 18 cases lesions of the "corpus striatum frontal plane of the hemisphere," which reaches the brain surface in the ascending frontal gyrus, was followed as a rule by increased rise of temperature in the opposite side of the body; lesions in other parts of the hemisphere were not so followed. He deprecated the use of the term "heat-centres," until the matter had been more fully investigated by experiment.

At the same meeting Dr. W. Hale White[7] gave an account of his researches on the influence on bodily temperature of lesions of the corpora striata and optic thalami. Rabbits were used for experiment, and the lesions were made by trephining the skull and inserting a wire in such a manner that portions of the central ganglia could be de-

[5] Brain, Part XLIV., 1889, p. 433.
[6] British Medical Journal, Vol. I. for 1889, p. 1406.
[7] *British Medical Journal*, Vol. I. for 1889, p. 1401.

stroyed without seriously damaging the upper part of the brain. Neither etherization nor trephining and pricking the dura mater caused long-lasting rise of temperature. Lesions of the white matter alone seemed incompetent to produce a rise of temperature. Twenty-three lesions of the corpora striata alone were followed in all except two cases by a rise averaging fifty-eight hours in duration, and equaling from 3° to 5.2° F. Nine lesions of the optic thalami alone caused a rise of 2°+ to 3°+, and averaging forty-two hours in duration. The nerve fibres that modify the temperature apparently do not cross in the rabbit, this animal thus differing from man.

Function of Mammalian Sympathetic Ganglia. — In 1887 Dr. W. Hale White published [8] the results of microscopic examinations of the superior cervical ganglia of man and numerous lower mammals, which tended to show that this ganglion gradually degenerates the higher one goes in the animal scale. He has since made further observations on this and other sympathetic ganglia.[9] As regards the superior cervical ganglion, in adult man the nerve cells as a rule were pigmented, granular, shrunken, non-nucleated, and degenerate in appearance, the degeneration being greatest in old persons; in children and fœtuses, the cells were like normal nerve cells; in twenty-one species of lower mammals, the cells were also like normal nerve cells, except in one of the Catarrhine apes, where slight evidences of degeneration existed. As regards the semilunar ganglia, thirty-three human specimens, three taken from children, showed normal nerve cells, while twenty-four adult ganglia showed degeneration; of eighteen lower mammals, all possessed cells of the normal type. In human thoracic ganglia, a few nerve cells possessed slight granularity and pigmentation, and this was more marked in aged individuals. The author draws the following conclusions:

"Firstly: That in lower mammals and young human beings the collateral ganglia (if we may judge from the superior cervical and semilunar) are functionally active, but that in monkeys there are evidences of the commencing loss of their function, which has completely disappeared in the human adult. Secondly: That in man the function of the lateral ganglia is maintained well into adult life, and only begins to disappear in old age."

[8] *Journal of Physiology*, Vol. VIII., p. 66.

[9] *Journal of Physiology*, Vol. X., 1889, p. 341.

ANTHROPOLOGY.

Congresses, National and International, held in Paris during, and a part of, the French Exposition of 1889.— There were about 120 such congresses; all such as would otherwise have been held in France, and many of those which would otherwise have been held in other countries in Europe, were held in Paris, in 1889.

The Congress of Archælogie and Anthropologie Prehistorique was the most important from the American standpoint of Archæology. There were enrolled 420 members. Of the foreigners there were Belgians, 56; English, 32; German, 28; Italian, 26; Danes, 13; Austrians, 11; Hollanders, 7; Portuguese, 13; Swedes, 8; Swiss, 7; Russians, 6; Finns, 6; Spaniards, 4; Americans, 5; though not all were present.

The first three seances of the congress were devoted to the questions relative to glacial phenomena, the formation of river valleys, and the classification to be made in prehistoric anthropology and paleontology during the quarternary epoch. The ancient theories relating to these questions, the latter especially, were maintained by Dr. Gosse, of Geneva, and Mortillet, of Paris. Their opponents were Mr. Evans, of London, and Monsieur Gosselet, of Lille. Dr. Schliemann occupied an afternoon in the discussion of his celebrated discoveries in Asia Minor. Mons. J. de Morgan rendered him much assistance in demonstrating the antiquity of the men of that epoch and locality by relating his discoveries in Armenia; a part of which antiquities the National Museum has just purchased from his brother, H. de Morgan. Interesting papers and discussion were read and had on the subject of the age of bronze and stone in Denmark, the antiquities of the Canary Islands, the Megalithic Monuments of Tunis, the Lacustrian of Roumania, the engraving and sculpture in southern France, particularly at the cavern of Mas d'Azil. The papers were read respectively by Dr. Sophus Muller, MM. Derneau, Hamy, Butzurneau, and Judge Piette. My own papers were those relating to the periods, paleolithic and neolithic, in America, and that on the subject of the gravels of Trenton in which Dr. Abbott has discovered paleolithic implements. MM. Fraipont and Lohest gave most interesting descriptions of their celebrated discoveries in the Grotto de Spy, Belgium. Dr. Topinard described his studies in the color of hair and eyes of the people of France. There were interesting papers and discussions by the Portuguese, Spaniards, Russians, Scandinavians, and Belgians.

The French Exposition was immense. It was a great success from an artistic, educational, financial, and expositional standpoint. It could scarcely be otherwise, for the French people and government were in perfect harmony, and thoroughly interested and determined in their efforts. They commenced with sufficient appropriations and in ample time to make it so. The total number of paying entries exceeded 25,000,000 persons; the average entries upon ordinary days were from 140- to 160,000, while on *fête* days, Sundays, extra music, illumination, fireworks, etc., the attendance ran up without effort to 250,000 and even 350,000.

I took with me 397 objects belonging to prehistoric America. One hundred and sixty-five were paleolithic implements which I had gathered up in the District of Columbia, a few weeks before sailing, for this purpose. I did not expect to bring these back, but I intended to use them for purposes of donation, exchange, etc. One hundred and eight of them were arrow- and spear-points, having the same destination. Eleven specimens, and one box containing uncounted and unnumbered specimens, were chips and flakes from Flint Ridge, and obsidian from the Pacific Slope, intended as a donation to M. de Mortillet, who is making a collection of this material, and has obsidian flakes and cores from almost every part of the world. Forty-five were plaster casts of the peculiarly shaped Indian objects of the United States, which were denominated by Dr. Rau as "Ceremonial." There were also a series of casts of pipes. Seventy-one were objects from the collection of Mr. W. K. Moorehead, and represented the celebrated discovery made last April in the Porter Mound, Roos County, Ohio. Twenty-eight were impressions of pottery, showing the decoration. Twenty-nine specimens were hard stone, and were intended, with the Moorehead collection, to be returned to me at Washington. The others were intended for gift or exchange. They proved exceedingly interesting to the prehistoric anthropologists who were in attendance upon the various congresses. I first endeavored to make a display of these objects in the halls used by the congresses, but found it to be unsuitable, and, by the advice of those who had the greatest knowledge and interest in the matter, I took them to the exposition, purchasing two glass-top cases, black in color, and respectable in appearance, and there displayed the entire collection. This was in accordance with the recommendation of Dr. Hamy, MM. Cartailhac, Boban, and others.

I directed that at the close of the exposition the objects remaining were to be disposed of as follows:

The principal portion of the paleolithic specimens were to go to the Musée of St. Germain, though several individual objects were to be given to MM. de Mortillet, Cartailhac, Capitan, d'Acy, and Boban. The plaster casts of the ceremonial and other curious objects peculiar to the United States will go to the Trocadero Museum in charge of Dr. Hamy.

I do not know whether any of these objects will figure in the catalogues of the exposition, but I was assured that all inspection and visits by the jury for the award of prizes had been made before my display was set up.—*Thomas Wilson.*

British Museum.—We landed in England on the 4th day of September, and spent the rest of our time until the 2d of October there and in Ireland. I visited the British Museum, and had several conferences with Mr. Franks, who is the Curator of the Department of Ethnology and Prehistoric Archæology. I had known him before, and my visit was very satisfactory. His department is being enlarged, and he will have room for a better and finer display. That portion of his department relating to prehistoric man has fewer objects than the same department in the National Museum; but it occupies greater space, and is consequently displayed to better advantage.

Mr. Franks receives an annual appropriation for the *purchase* of specimens for his department of £1,200, equal to $6,000, besides a fund left by Mr. Christy, of which Mr. John Evans and Mr. Franks are trustees, the income of which, however, I do not know. The Christy fund has furnished many of the objects in the Museum. It, with some aid from the Museum, I believe, has lately purchased the magnificent collection of Mons. Peccedeau de Lisle, of Toulouse, France, comprising a full series of the cavern implements and objects of France, and including his great find at the cavern of Bruniquel, being the largest part of the known examples of sculptured and engraved bone and horn and ivory objects belonging to the paleolithic period. I did not wish to ask the prices paid for this collection, but when I examined it at Toulouse the lowest price at which it could have been purchased was 40,000 francs, equal to $8,000. It is now displayed in the paleolithic room at the head of the stairs in the British Museum. It contains the three well-known and unique sculptures in the round, of ivory and reindeer horn, two representing a reindeer and the other a mammoth. There are many other drawings and engravings etched or engraved upon bone or stone, some of which show great artistic power. The report of this department in Parliamentary

Paper No. 229, 1888, says: "This acquisition renders the collection at the Museum of ancient cave remains the most complete that is known to archæologists."

I visited the Kensington Museum and the Museum of Natural History, now presided over by Prof. W. H. Flower. Prof. Flower was president of the British Association at Newcastle this year, and his address was devoted to the organization of museums so as to produce the greatest benefit for students and for the public.—*Thomas Wilson.*

ENTOMOLOGY.

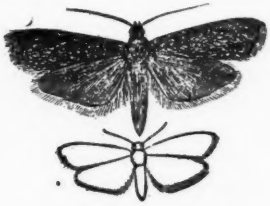
The Flour Moth.—A new insect pest has recently made its appearance on the continent of America. It is known as the flour moth (*Ephestia kuhniella*), and its ravages, as its name indicates, are seen in the destruction of flour, in which it weaves its webs, and upon which the caterpillar feeds. As it is very destructive, and increases with marvelous fecundity, it is of the utmost importance that every precaution should be taken to prevent its spread.

The flour moth is indigenous to the Mediterranean, and a few years ago it would have been likely to stay there. But increasing commerce has its attendant dangers. Experience has shown that as trade in the milling industry enlarges, weed and insect pests, confined at one time to a certain locality, have spread to places far distant. The flour moth has probably come to America with importations of seed wheat, or in bags in which flour has been exported, and which before their return may have been stored for a time in some place infested by the insect.

The color of the fore-wings of this moth may be generally described as of rather pale gray, with darker transverse markings. The hind wings are peculiar for their whitish semi-transparency, with a darker line from the point along a part of the fore edge. The accompaning illustration will convey a general idea of the appearance of the moth.

An examination of the flour infested by the insect shows a mass completely spun together with the web. Giving the result of his investigations, an expert tells us he found it so matted together that, after pulling some lumps of it away, he found that the rest hung down

in rag lumps or clots, so felted together that little flour remained in a loose state. From a mass of these clots, containing two or three cubic



(a). Moth (imago) magnified.
(b). Outline, showing natural size.

Moth (imago) slightly magnified; sessile or quiescent.

inches, only a teaspoonful of flour could be obtained by repeated shakings. The mass was filled with live caterpillars, living and dead chrysalids, and remains of dead moths. Going on to describe the appearance of these caterpillars, he says:

Caterpillar (larva), natural size.

"The caterpillars varied in size from two-eighths up to five-eighths of an inch in length, and correspondingly in color, the younger ones being of flesh or pale red color, and the largest almost white; the shape cylindrical, somewhat slender, with sixteen feet,—that is, three pairs of claw-feet, four pairs of sucker feet, and a very well-developed pair besides beneath the tail, by the help of which, although the largest of the larvæ were sluggish, the younger traveled nimbly, and could move backwards or forwards at pleasure, or were able to attach themselves at once to a foreign substance, as the finger or hand. The head yellowish brown, darker in front, and with dark brown jaws; a transverse patch on the segment next the head, this rather pale yellowish brown, with a faint pale central line dividing it from back to front, and (in the oldest specimen) a small brown spot on each side of the segment below the patch. Along the back, excepting towards the head and tail, were four small dark dots on each segment above, two on each side the centre. On the segments near the head the spots were arranged more transversely, and at the tail, immediately above the sucker-feet, was a brownish, oval or somewhat triangular patch (the anal plate). On the preceding segment one transverse row of spots varied somewhat in different specimens; the largest was in the middle, with a smaller one on each side, occasionally one below, which would make five altogether; but sometimes the lowest pair was absent, sometimes the middle large spot was not

entire; conjecturally the marking differed with the age of the caterpillar. On the preceding, that is, the eleventh segment, there were two clearly defined brownish spots, and along each side of the caterpillar was a row of dark dots, one on each segment.

"The caterpillar was slightly sprinkled with pale hairs or fine bristles, and had such a capacity for catching and retaining a covering of flour that I was obliged perpetually to remove it with the moistened tip of a finger to obtain a clear view of the markings.

Chrysalis (pupa), natural size, but stripped from the film of flour surrounding it.

Cocoon as it appears in most instances.

"The chrysalis, which was lying in a silken cocoon of spun-up flour, showed the chief points of the form of the coming insect plainly—the color bees-wax below, shading to reddish-brown on the back, and reddish-brown also at the end of the somewhat prolonged, slightly-curved tail, which ended bluntly or cylindrically; the eyes of a darker shade of red. There were remains of dead, partly developed moths or chrysalids in the box, but I could not make sure whether, as thought not unlikely by Professor Zeller, these had been destroyed by their caterpillar brethren—the size and power of their jaws make the cannibal habit appear very probable. I had not opportunity of observing how long the chrysalis state lasts before the moth appears from the chrysalis condition, but this time is given by Professor Zeller as three weeks."

From all that can be learned of the habits of this insect it would appear that it is unceasing in its ravages where the temperature is suitable, in fact that it is an all-the-year-round pest. The pupa stage being short, its multiplication is very rapid. How rapid is shown by the fact that a large warehouse, 75 feet long, 25 feet wide, and four stories high, became literally alive with moths in the short space of six months, while thousands of cocoons were found adhering to the walls, ceilings, and joists, and in every crack, crevice, and nail-hole, necessitating a thorough cleansing of the entire building and its contents, the burning of a great deal of the wood-work, and the disinfecting of the whole place to destroy any germs that might possibly have escaped.

The first appearance of the flour moth in Canada that I can learn of was in March, 1889, when it was observed in a mill in Ontario. Little attention was paid to it, as its dangerous character was not known; but by and by the moths began to appear in greater numbers, and soon small worms were observed in the flour. Alarm began to be felt, and

it was suspected that these worms came from the moths which had been seen in the mill. In July the bolting cloths, elevators, and some other parts of the machinery, were carefully cleaned and washed. In about four days after starting again, the bolts, elevators, etc., were found to be in a worse state than ever, full of webs, moths, and worms. The mill was shut down and a more thorough cleansing set about. But it was found that every crack and crevice was alive, and as the character of the moth was entirely new, an application was made to the Government for assistance. A number of visits were made to the infected mill by the authorities, and an order in council was passed by the Government ordering the Provincial Board of Health for Ontario to suppress the pest. The machinery was taken down and thoroughly steamed; the building was swept and subjected to the fumes of burning sulphur; the loose wooden parts, such as elevator spouts, etc., were burned, and paper bags, boxes, and any goods suspected of being infected, were similarly disposed of. Even the mill-stones and iron rollers were thoroughly steamed by placing them in a tight box with a pipe from the boiler. After about two months' loss of time, and a large outlay for new machinery, stock, etc., the mill was pronounced free from infection and ready to go to work again. As may be supposed, its proprietors have taken such precautions as will prevent the pest gaining a footing should it again make its appearance. They have provided a steam stand-pipe, with hose leading to each flat of the mill, so that live steam can be turned on sufficient to kill anything.

The importance of dealing promptly with the Flour Moth whenever and wherever it appears, has led the Ontario Government to issue a bulletin, in which the following precautions are suggested to prevent its introduction, and means of eradication pointed out should it appear: (1) no milled goods, such as Italian semolina, Indian cassava, and Brazilian tapioca, should be allowed to enter the country, especially from Mediterranean ports, without being quarantined in a warm place for a number of months, so as to give time for the ova, if present, to hatch; (2) all bags used for transporting flour, meal, or grain should be prevented from entering the country till they have been thoroughly boiled or steamed so as to kill any germs; (3) millers, exporters and importers of flour or grain should familiarize themselves with the appearance and habits of the moth at its various stages, and take measures to destroy individual specimens before they have time to multiply. Should the pest have made its appearance the following measures are recommended: (1) Destroy the moths by closing all apertures and burning sulphur night after night in all parts of the

building; (2) search for the larva or caterpillar in all packages of flour and meal, and if any are found superheat in a dry kiln by spreading it out in a thin layer so the heat can reach all parts; (3) do not under any circumstances sell infected flour to dealers, but have it steamed and fed to hogs; (4) where webs are found it may be considered that the larva has reached the chrysalis stage, and the cocoons, or little masses of flour glued together, being little rolls about three-quarters of an inch long, should be gathered up and burned. It must be remembered, however, that the larva has a habit of retiring to some crevice where it may be impossible to reach it, in which case watch should be kept for the moths as they emerge from the chrysalis, and they should then be killed. In such case sulphur fumes should be used. When the larvæ have gained possession of any part of the machinery, superheated steam must be used.

Where the use of sulphur might be attended with danger, chlorine fumes may be used with equal benefit. Infested places may also be sprayed with a solution of corrosive sublimate, consisting of one drachm to each gallon of water, or with a soap emulsion consisting of two gallons of kerosene, one of water and half a pound of whale oil soap. The solution of soap should be heated and addded boiling-hot to the kerosene, and then thoroughly mixed by means of a force-pump and spray-nozzle. One part of this emulsion should be used with nine parts of water. Prof. Riley, who gives the above formula, lays great stress upon having kerosene properly emulsified when used as an insecticide.

By adopting the above precautions this pest, which if allowed to go on unchecked soon becomes worse than any of the plagues of Egypt, may be kept down. The prompt measures already taken have to all appearance stopped its spread in Canada, but it is liable to appear again at any time. It has been seen in the United States but does not appear to have done any mischief. With the intimate trade relations which exist between the two countries its spread in one would soon be followed by its appearance in the other. Eternal vigilance is the price of freedom from its ravages, and attention having been called to it, millers and others likely to suffer should be on the alert.—J. J. Bell, *Brockville, Canada.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History.— Prof. W. Putnam, the president, announced the death of Leo Lequereaux, of Columbus, O., a corresponding member. Dr. Thomas Dwight read a paper on "The Joints and Muscles of Contortionists," illustrated by stereopticon. He said that there were contortionists in ancient Egypt, but very poor ones. Those of Greece and Rome were better, but those of modern times have still more ability. He showed some pictures of mediæval and modern contortionists in different positions, and said that for backward contortion no very great variation from the normal in anatomical structure was required, but there must be a large amount of gristle in the spinal column, as is the case in all children. In forward work, however, an abnormal structure is required, as the contortionist must have the power to partly dislocate his joints in order to get his limbs into the required positions. The performers of both classes must be able to relax the antagonistic muscles,—that is, those that pull in an opposite direction to which it is desired to bend.

Secretary Fewkes then read a communication from Prof. G. Frederick Wright, of Oberlin, in regard to a little carved figure of a man that was thrown up from a depth of three hundred and twenty feet below the surface of the ground, while boring for an artesian well at Nampa, I. T. This was accompanied by an opinion from Prof. S. F. Emmons, that the formation from which the figure came was older than any other where human implements have previously been found. The gentlemen who took part in the discussion were Profs. Putnam, H. W. Haines, Edward S. Morse, S. H. Scudder, and E. D. Cope, and Mr. Warren Upham. Prof. Cope stated that the formation underlying the lava bed in that part of Idaho, is the Pliocene lacustrine deposit, which he had called the Idaho Terrane. The general opinion seemed to be that the image was authentic, and that it was carved in the late tertiary period by a member of a race that was far advanced in development for so remote a period. Mr. Scudder was the only speaker who dissented from this opinion.

American Geological Society.—The annual meeting was held December 26–28, 1889, at the American Museum of Natural History, New York. The following papers were read December 26th: Some Additional Evidences Bearing on the Interval between the Leading Glacial Epochs; T. C. Chamberlain, Madison, Wis. The Tertiaries of Massa-

chusetts; N. H. Shaler. The Laramie Group; J. S. Newberry, New York. On Glacial Phenomena in Canada; Robert Bell, Ottawa, Canada. Orographic Movements in the Rocky Mountains; S. F. Emmons, Washington, D. C. Note on the Serpentine of Syracuse; Geo. H. Williams, Baltimore, Md. Remarks on the Surface Geology of Alaska; I. C. Russell, Washington, D. C. Origin of the Rock Pressure of Natural Gas in the Trenton Limestone of Ohio and Indiana; Edward Orton, Columbus, Ohio. On the Tertiary Deposits of the Cape Fear River Region; William B. Clark, Baltimore, Md. Note on the Pre-Palæozoic Surface of the Archæan Terranes of Canada; Andrew C. Lawson, Ottawa, Canada.

December 27th.—The Structure and Origin of Glacial Sand Plains; William M. Davis, Cambridge, Mass. Glacial Features of Parts of the Yukon and Mackenzie Basins; R. G. McConnell, Ottawa, Canada. Post-Tertiary Deposits of Manitoba and the Adjoining Territories of Canada; J. B. Tyrrell, Ottawa, Canada. A Moraine of Retrocession in Ontario; G. Frederick Wright, Oberlin, Ohio. The Southern Extension of the Appomatox Formation; W. J. McGee, Washington, D. C. The Value of the Hudson River Group" in Geologic Nomenclature; Charles D. Walcott, Washington, D. C. The Calciferous Formation in the Champlain Valley; Ezra Brainerd and H. M. Seely, Middlebury, Vt. The Fort Cassin Rocks and their Fauna; R. P. Whitfield, New York. The Stratigraphy of the Quebec Group; R. W. Ells, Ottawa, Canada. Geological and Petrographical Observations in Southern and Western Norway; Geo. H. Williams, Baltimore, Md. Cretaceous Plants from Martha's Vineyard; C. D. White, Washington, D. C. The Sandstone Dikes of the Forks of Cottonwood Creek, in Tehama and Shasta Counties, California; J. S. Diller, Washington, D. C. On the Relation between the Mineral Composition and the Geological Occurrence of the Igneous Rocks at Electric Peak and Sepulchre Mt., Yellowstone National Park; Jos. P. Iddings, Washington, D. C. On Certain Peculiar Structural Features in the Foothill Region of the Rocky Mountains near Denver, Colorado; Geo. H. Eldridge, Washington, D. C. Illustrations of the Glaciers in the Selkirk Mts. and Alaska; A. S. Bickmore, New York.

December 28th.—Some Results of Archæan Studies; Alexander Winchell, Ann Arbor, Mich. Significance of granitoid oval areas in the Laurentian; C. H. Hitchcock, Hanover, N. H. Porphyritic Granite; B. K. Emerson, Amherst, Mass. The internal relations and taxonomy of the Archæan of Central Canada; Andrew C. Lawson,

Ottawa, Canada. The Crystalline Schists of the Black Hills of Dakota; C. R. Van Hise, Madison, Wisconsin. On the intrusive origin of the Triassic Traps of New Jersey, with special reference to Watchung Mountains; Frank L. Nason, New Brunswick, N. J. The Geology of the Crazy Mountains, Montana; J. E. Wolff, Cambridge, Mass. The Cuboides Zone and its Fauna, A discussion of methods of correlation; H. S. Williams, Ithaca, N. Y. On the Pleistocene Flora of Canada: Abstract; Sir William Dawson and D. P. Penhallow, Montreal, Canada. The Fiords and Great Lake Basins of North America considered as evidence of preglacial continental elevation and of depression during the glacial period; Warren Upham, Somerville, Mass. On the Genus Spirifera and its inter-relations with the Genera Spiriferina, Syringothyris, Crytia, and Cryotina: Abstract; James Hall, Albany, N. Y. On some Ancient Shore-lines and their history; F. J. H. Merrill, New York. Geology of the Boston Basin; W. O. Crosby. On the Collection and Preservation of Geological Photographs by the American Geological Society, and the facilitation of their exchange among its members; J. F. Kemp, Ithaca, N. Y. On the Metamorphic Rocks of south-eastern New York; F. J. H. Merrill, New York. Experiments with Cave Air for cooling and ventilating rooms; M. H. Crump. On some Porphyries of the Plain of Mexico, read by title; Persifor Fraser, Philadelphia, Pa. On the Horned Dinosauria of the Laramie, read by title; E. D. Cope, Philadelphia, Pa. On Pot-holes north of Lake Superior unconnected with existing streams; Peter McKellar, Fort William, Ontario.

The following is an abstract of some of the more important papers read at the meeting.

On Glacial Phenomena in Canada. Robert Bell, Ottawa, Canada.—Advantages offered by the Dominion for the study of these phenomena. Questions as to interglacial periods. Preglacial or interglacial river valleys. Boulder Clays ploughed by subsequent glaciers. Almost universal glaciation east of the Rocky Mountains. Progressive recession northward of the general glacial condition. Surface decay preceding the glacial period. Directions of striæ and drift transportation. Effects of regional changes of level in the northern part of the continent. Different origins of lake basins. Influence of geological conditions on glacial erosion in the production of geographical features. Did other forms of ice play any part? Examples peculiar to glacial action. Various proofs. Groups of general courses of grooves in different directions. Various forms of moraines, belts, trains, heaps,

beds, and areas of boulders. Erratics remarkable for size, position, etc. Climate and fauna in post-Pliocene times. The paper was illustrated by photographs and diagrams.

THE STRUCTURE AND ORIGIN OF GLACIAL SAND PLAINS. William M. Davis, Cambridge, Mass.—Sand Plains are delta-like deposits of stratified gravel and sand, formed in bodies of standing water at the margin of the melting ice of the last glacial epoch. Their growth was rapid compared to the backward melting of the ice-front, and the pits in their surface mark the location of isolated blocks of ice, which their sands surrounded.

NOTE ON THE PRE-PALÆOZOIC SURFACE OF THE ARCHÆAN TERRANES OF CANADA. Andrew C. Lawson, Ottawa, Canada.—Observations along the northern limit of the Palæozoic show that the surface of the Archæan was, at the time of the deposition of Cambrian or earlier formations, to a large extent as hummocky and *roches moutonnées* as it is to-day. Hence this feature cannot, as it is generally supposed, be due to conditions of glacial epoch except to a very limited extent. Slight reduction of the Archæan surface since early Palæozoic, but enormous previous denudation. Origin of material of post-Archæan formation.

GLACIAL FEATURES OF PARTS OF THE YUKON AND MACKENZIE BASINS. R. G. McConnell, Ottawa, Canada.—This paper contains a brief description of the glacial deposits observed along the Liard and Mackenzie Rivers, and includes notes on the silting up of a southern arm of Great Slave Lake, on the height of Erratics along the eastern flanks of the Rocky Mountains, on the absence of Boulder Clays from the valleys of the Porcupine and the Yukon, and on the former existence of a great lake at the confluence of these two streams.

REMARKS ON THE SURFACE GEOLOGY OF ALASKA. I. C. Russell, Washington, D. C.—The writer wishes to call attention to, first, the formation of the Tundra; second, to the absence of residual clays and other evidences of rock decay and the absence of glacial records along the Yukon and Porcupine Rivers in Alaska.

POST-TERTIARY DEPOSITS ON MANITOBA AND THE ADJOINING TERRITORIES OF CANADA. J. B. Tyrrell, Ottawa, Canada.—The area stretching from the Archæan nucleus in the eastern portion of Manitoba, to near the foot of the Rocky Mountains, has, in preglacial times, had a very irregular surface, which was planed by the passing of the continental glacier, and the irregularities filled often to great depth with unstratified till. This till, or ground moraine, forms the

present surface throughout large districts; but it is covered in many places by stratifieds ands, silts, and gravels deposited in the beds of larger or smaller fresh-water lakes. The paper describes the character of the till, the direction in which the glacier forming it has moved from the Archæan nucleus, and some of the moraines, drumlins, kames, etc., that it has left in its course; also it states evidences of the recurrence of glacial conditions, and the positions of a number of lakes in which the subsequent deposits were laid down.

A Terminal Moraine in Ontario. G. Frederick Wright, Oberlin, Ohio.—In the Report of Progress upon the Geological Survey of Canada, published in 1863, pp. 908, 909, the Artemisia gravel is described as a belt of loose gravel extending from Owen Sound to Brantford, and thence in an easterly and northeasterly direction, passing about half way between Lake Ontario and Lake Simcoe, following the highest ground of the peninsula, and being in general about 950 feet above the sea. Lakes with no visible inlet are described as occurring near the greatest elevation. The object of the paper is to give the results of personal investigations during the past summer along this line, demonstrating its morainic character. Many facts which some have attributed to a northern depression at the close of the glacial period receive simple and sufficient explanation from the morainic character of this deposit.

The Southern Extension of the Appomattox Formation. W. J. McGee, Washington, D.C.—The Appomattox formation was applied in 1888 to a widespread deposit of orange-colored sands and clays, with occasional intercalations of gravel, developed on and between the Rappahanock, James, Roanoke, and Appomattox rivers in eastern Virginia, and widening and thickening southward. Recently the same formation has been traced through the Carolinas, Georgia, Alabama, and Mississippi; and has been found to constitute the prevailing surface deposit in these States. It is a marine or brackish water deposit, yielding no fossils save fragmentary cones and bits of lignite. A considerable part of the Orange Sand of Dr. Hilgard belongs to the formation. It lies unconformably upon the Grand Gulf (Miocene?) strata of Alabama and Mississippi as upon the fossiliferous Miocene of eastern Virginia and North Carolina, and it is overlain unconformably by Plistocene deposits in various localities. Although its age has not been determined palæontologically, it forms, by means of its vast extent and uniform character, a great datum formation from which the stratigraphy of the Coastal plain may be reckoned.

THE TERTIARY DEPOSITS OF EASTERN MASSACHUSETTS. N. S. Shaler, Cambridge, Mass.—The main points concern the origin and distribution of these strata. The writer endeavored to show that there has been in that district, since the Miocene time, a large amount of true mountain-building action; and also that a part of the deposits are of Glacial origin.

THE VALUE OF THE TERM "HUDSON RIVER GROUP" IN GEOLOGIC NOMENCLATURE. Chas. D. Walcott, Washington, D. C.—This paper embraces: Description of the rocks referred to the Hudson River group in the valley of the Hudson; comparison of the Hudson River section with the section in Loraine, Jefferson county, N. Y., and the Cincinnati section of southern Ohio; some observations on the use of the names "Hudson River," "Lorraine," and "Cincinnati."

THE CALCIFEROUS FORMATION IN THE CHAMPLAIN VALLEY. Ezra Brainerd and H. M. Seely, Middlebury, Vt.—This paper describes the series of Champlain Valley rocks, and presents the results of the authors' study of the Calciferous and its relations to the groups above and below. The observations have led to important conclusions, involving serious modifications of the section as generally accepted.

THE STRATIGRAPHY OF THE QUEBEC GROUP. R. W. Ellis, Ottawa, Canada.—The author discusses, first, all the structure as found in the southeastern part of the province adjoining Maine and New Hampshire, including the crystalline and metamorphic rocks and their associated formations; and subsequently the unaltered Quebec group as developed along the south side of the St. Lawrence. He contrasts the views formerly held regarding the stratigraphical position of the several divisions with those now believed to be the correct interpretation. The new views of structure of the St. Lawrence area have been largely confirmed very recently by the work of Prof. Lapworth and others from the palæontological standpoint.

GEOLOGICAL AND PETROGRAPHICAL OBSERVATIONS IN SOUTHERN AND WESTERN NORWAY. George H. Williams, Baltimore, Md.—The regions studied in southern Norway are of typical eruptive rocks breaking through horizontal and unaltered Silurian beds, and therefore unexcelled as examples of contact metamorphism. The localities visited in western Norway, on the other hand, are greatly disturbed and have been subjected to extensive regional metamorphism. In each case, both eruptive and sedimentary masses have been involved, but neither have so completely lost their original characters by metamor-

phism as to be incapable of identification. The two main points which it is desired to illustrate are: I. The similarity of effects produced in the same original material by the contact action of eruptive rocks and by orographic disturbance. II. The power of orographic forces (regional metamorphism) to produce the same product from rocks originally the most diverse in origin and structure. Illustrated by maps, diagrams, and specimens, both macroscopic and microscopic.

NOTE ON THE SYRACUSE SERPENTINE. George H. Williams, Baltimore, Md.—Additional and recently secured evidence of the eruptive nature of this rock, which is interesting as being the only representative of its class known in the undisturbed strata of New York.

THE SANDSTONE DIKES OF THE FORKS OF COTTONWOOD CREEK IN TEHAMA AND SHASTA COUNTIES, CALIFORNIA. J. S. Dilier, Washington, D. C.—The distribution of the dikes was shown by a map, their mode of occurrence described and illustrated by lantern slides; their mineralogical composition, microscopical structure, and chemical composition discussed and compared with that of the mesozoic sandstones with which they are associated; and a theory of the origin of the dikes proposed and discussed.

ON THE RELATION BETWEEN THE MINERAL COMPOSITION AND THE GEOLOGICAL OCCURRENCE OF THE IGNEOUS ROCKS AT ELECTRIC PEAK AND SEPULCHRE MT., YELLOWSTONE NATIONAL PARK. Jos. P. Iddings, Washington, D. C.—An occurrence of intrusive rocks and contemporaneous extravasated rocks having similar chemical composition and different mineral composition and structure.

ON OROGRAPHIC MOVEMENTS IN THE ROCKY MOUNTAINS REGION. S. F. Emmons, Washington, D. C.—After giving a brief abstract of the views which have hitherto been put forward in regard to orographic movements in the Rocky Mountains region, the writer proceeds to give his present views, founded on observations made in the field during the past ten years, which partially modify the views already held, and add to the list of movements two important and widespread movements, which hitherto have not been generally recognized. These occurred, the one during the Carboniferous, the other during Jurassic times. Evidence of the former is found beyond the boundaries of Colorado in Wyoming at the North and New Mexico on the South. The latter was even more widely felt and may have affected the greater part of the continent. Although the data are extremely imperfect, the writer has thought it advisable to present the facts which he has at his command, believing that when the attention of geologists is called to

them, they may be able to detect further evidence, where, without this suggestion, they might not look for it.

On Certain Peculiar Structural Features in the Foothill Region of the Rocky Mountains near Denver, Colorado. Geo. H. Eldridge, Washington, D. C.—The paper describes a type of geological structure discovered by the writer, which may prove of common occurrence along the base of the Rocky Mountains. The type consists in a succession of nonconformities appearing one after another at various geological horizons, the explanation of which is found in the forces acting in the general uplift of the Colorado Range, from which have been developed certain secondary forces, which have, from point to point, brought about the elevations upon which the nonconformities depend.

On the Intrusive Origin of the Triassic Traps of New Jersey; with Special Reference to Watchung Mountains. Frank L. Nason, New Brunswick, N. J.—That these traps are intrusive in their origin is proved: I. By the peculiar monoclinal structure of the sandstones, which are produced by longitudinal fractures extending parallel (a) to the major axis of the trap ridges, and (b) to the major axis of the Archæan region. II. By the finding of *Estheria ovata* in repeated lines along the Delaware River, and in lines reaching N. E. and S. W. across the State. III. By the lines of cross-fracture extending N. W. and S. E. across the formation, which are proved (a) by showing a repetition of the slates and gray sandstones at Weehawken and Shady Side; (b) by showing that the Pequannock River flows in a fault; (c) by showing that the streams of the Archæan region flow in faults parallel to the "crescents" of the trap.

Association of American Anatomists.—The second annual meeting was held at the University of Pennsylvania, Thursday, December 26, 1889. The following communications were made: President's Address; by Joseph Leidy, M.D., of Philadelphia, Pa. Address of the Chairman of the Executive Committee; by Harrison Allen, M.D., of Philadelphia, Pa. Muscular Anomalies of the Infra-Clavicular Region; by Frank Baker, M.D., of Washington, D. C. On Plant Anatomy and Physiology; by W. P. Wilson, M.D., of Philadelphia, Pa. Brief Remarks on the Form and Probable Function of the Blood Plaque, with slides and photographs; by George T. Kemp, Ph.D. Presentation of Histological Specimens; by George A. Piersol, M.D., Philadelphia, Pa. The Supra-Sternal Rib; by D. S. Lamb, M.D., of Washington, D. C. A Demonstration; by Horace Jayne,

M.D., Philadelphia, Pa. A Paper,—title unannounced; by Wm. Browning, M.D., Brooklyn, N. Y. The Relation of the Thalmus to the Parocœle (lateral ventricle), especially in the Apes; by Burt G. Wilder, M.D., Ithaca, N. Y. Nuclear Anatomy of the Cetacean, Manatee, Phocidæ, and Hippopotamus Cord; by E. C. Spitzka, New York.

Friday, Dec. 27th.—The Spinal Nerves of the Cat (advance communication); by T. B. Stowell, Ph.D., Pottsdam, N. Y. The Transition from Stratified to Columnar Epithelium; by Simon H. Gage, Ithaca, N. Y. A Series of Casts of the Duodenum, with remarks; by Thomas Dwight, M.D., Boston, Mass. The Preparation and Preservation of Anatomical Specimens for Museums (illustrated with specimens); by J. L. Wortman, M.D., Washington, D. C. Notes on Dwarfs; by Frank Baker, M.D., Washington, D. C. Olecranon Perforation; by D. S. Lamb, M.D., Washington, D. C. The Physical Theory of the Genesis of the Long Bones and Articulations; by John A. Ryder, M.D., Philadelphia, Pa. Individual Skeletal Variations; by Frederick A. Lucas, Washington, D. C. Medico-Legal Studies on the Human Skeleton; by Thomas Dwight, M.D., Boston, Mass. On the Value of the Studies of Variation; by Harrison Allen, M.D., Philadelphia, Pa. The Heart as a Basis of Intrinsic Toponymy; by Burt G. Wilder, M.D., Ithaca, N. Y. Presentation of Specimens; by Geo. McClellan, M.D., Philadelphia, Pa.

Saturday, Dec. 27.—Presentation of Specimens; by S. J. J. Harger V.M.D., Philadelphia, Pa. Presentation of Specimens; by John B. Deaver, M.D., Philadelphia, Pa. Presentation of Specimens; by A. H. P. Leuf, M.D., Philadelphia, Pa. Volunteer contributions. Inspection of Veterinary Department.

The following officers were elected: President, Joseph Leidy, M.D.; First Vice President, Frank Baker, M.D.; Second Vice President, Fanueill D. Weisse, M.D.; Secretary and Treasurer, A. H. P. Leuf, M.D.; Executive Committee, Harrison Allen, M.D., Chairman, Burt G. Wilder, M.D., William Towles, M.D., the President and Secretary.